

# THE LARYNGOSCOPE.

---

VOL. LXIX

NOVEMBER, 1959

No. 11

---

## REVIEW OF THE AVAILABLE LITERATURE OF THE LARYNX FOR 1958.\*

FRANCIS E. LEJEUNE, M.D.,  
and  
MERCER LYNCH, M.D.,  
New Orleans, La.

### PHYSIOLOGY.

The student of laryngeal physiology encounters a wealth of diverse information on the subject of voice formation. Because of lack of adequate equipment, few investigators have made any attempt to discover the secrets of the vibratory pattern. The scientific advances of ultra high speed photography and the electronic synchronstroboscopy have made this possible. Using the ultra high speed motion picture, Timcke and associates<sup>1</sup> explored the details of laryngeal vibration during the opening and closing phases of the vibratory cycle. Their technique is given in detail. Their findings are given regarding (A) chest voice at weak to medium intensity, (B) chest voice at extremely weak intensity, (C) intensity changes in chest voice, and (D) pressure changes in chest voice.

In an exhaustive investigation Moore and von Leden<sup>2</sup> conclude that voice production is a dynamic process constantly changing in behavior rather than a repetition of the same vibratory movement. These investigations carried through laughter, abduction, adduction, vibration and numerous other phases are well depicted graphically. The fundamental pur-

\*From the Department of Otolaryngology, Ochsner Clinic, New Orleans, La.

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication Sept. 20, 1959.

pose of this investigation was to discover new information about the physiology of the normal larynx during voice production. Moore and von Leden<sup>2</sup> propose a new term, "dis-crotic dysphonia," to express the physiologic vibratory pattern in the voice quality presently called "glottal fry."

Nakamura and associates<sup>3</sup> made a study of the electrical activity of five intrinsic laryngeal muscles of the dog during respiration by means of electromyographic recordings. They noted that the abductor was active during inspiration, and the adductors showed activity during expiration except the thyro-arytenoideus, which remained quiet throughout the respiratory cycle. No change in activity after detachment of the trachea indicates that respiratory movements of the glottis may be controlled centrally without reference to a local sensory information. The pattern of activity of the laryngeal muscles was extremely similar to that of intrinsic respiratory muscles.

Furstenberg<sup>4</sup> reviews the pathway of motor nerve control of the larynx and upper extremities. In experimental study on monkeys the primary motor area for the larynx was located; also, additional motor areas to the larynx were definitely demonstrated. These motor areas may be spared when the primary motor field or the pyramidal systems are destroyed. Obviously, these reserve motor areas would help in laryngeal function. Some of these additional motor areas are in fields where the connections suggest they have to do with emotional responses.

In patients with hysterical aphonia there is obviously a central inhibitory effect upon the corticobulbar fibers carrying motor impulses to the nucleus ambiguus. When emotionally aroused, these patients may scream loudly or speak audibly and distinctly. Furstenberg states that secondary motor areas are definitely demonstrated in the cortex of monkeys; it is logically assumed phylogenetically that a similar pattern of motor innervation for the larynx is present and more highly developed in man.

During "silent speech" Faaborg-Andersen and Edfeldt<sup>5</sup> noted an increase in electrical activity in the vocal and mylo-

hyoid muscles and a reduction in the posterior crico-arytenoid muscle. The change in electrical activity was considerable in subjects with low reading ability. This work was performed on ten volunteers, all free of disease, electrodes being inserted into the vocal and post-crico-arytenoid muscles and into the mylohyoid muscle.

Tschiasny<sup>6</sup> coined the word necrophonia to designate the laryngeal sounds that may appear under certain conditions as a spontaneous postmortem phenomenon. He shows this phenomenon by use of models and then by use of larynges and air under pressure. It is explained by rigor mortis and gas forming bacilli in the lungs and air passages.

#### PATHOLOGY.

Epstein<sup>7</sup> presents a simple, practical technique for systematic histologic examination of the total epithelial field of the larynx. At operation or necropsy the larynx is opened posteriorly by longitudinal splitting, and it is forcibly kept open. Longitudinal strips from the epiglottis to the lower border of the cricoid are obtained in a regular pattern well described by the author. This stripping technique is considered far superior to other methods in vogue for histologic examination of the larynx.

Keen and Wainwright<sup>8</sup> collected, dissected and studied 133 larynges from adult subjects for evidence of bony changes; the methods of study included radiography and histology. A definite pattern of progressive ossification for the thyroid, cricoid and arytenoid cartilages was noted. There were considerable sexual differences in the manner in which the ossification process affected the thyroid cartilages. The radiologic observations were confirmed by histologic sections. In addition, as a precursor to ossification, vascular changes and fibrillary degeneration were noted in the laryngeal cartilages. It was noted that bony changes in the thyroid and cricoid cartilages usually begin during the third decade but, in general, correlation between advancing age and progressive ossification was poor. The conclusion is drawn that "ossification in the laryngeal cartilages is a genetically controlled

normal occurrence, and is not a simple degenerative process associated with advancing age."

#### ANOMALIES.

Triboletti<sup>9</sup> reports a case of a rare congenital anomaly, a common laryngotracheo-esophageal tract extending from below the bifurcation of the trachea up to and involving the posterior surface of the larynx in a newborn infant. The esophagus was patent throughout and communicated with the stomach. The baby died on the fourth day of life.

Sonninen and Vahe<sup>10</sup> report a case of laryngeal asymmetry, a frequent cause of voice disorder. The asymmetry produced considerable vocal difficulty consisting of the left cord's being shorter and on a higher level than the right cord, giving the glottic chink an oblique appearance. Surgical correction by splitting the thyroid cartilage in the median line and inserting a piece of rib cartilage between the thyroid alae and the perichondrium resulted in fixation of the cord in medioposition. Rehabilitation of the voice was good, and the patient was able to resume his occupation as a lawyer.

#### DISEASES.

According to Silverblatt,<sup>11</sup> diseases of the larynx are treated predominantly by surgical procedures except for antibiotics in the acute infectious reactions and streptomycin in tuberculous laryngitis. He has used antibiotic steroid combinations in many laryngeal problems, including acute laryngitis, contact ulcers, laryngeal polyps before and after operation, papillomas and postoperatively in cases of hyperkeratosis and leukoplakia, for the past two years with notable benefit.

Myerson<sup>12</sup> urges vocal rest in certain laryngeal conditions characterized by edema or inflammatory reactions on the vocal cords. He rightly advocates vocal rest in the early stages of vocal nodules and the edematous manifestations after excessive smoking. Vocal rest is as important preoperatively as postoperatively. The cords should not be used until the operated area on the cord has had a chance to heal. In cases in which fibroblasts develop there is little reason to consider



vocal rest, as fibrous tissue is irreversible, and no amount of silence will make it disappear.

Laskiewicz<sup>13</sup> presents an interesting article on pharyngolaryngeal disturbances due to cervical spondylosis. He attributes cervical spondylosis to the degenerative changes within the small articulations of the cervical spine as a consequence of over-strain or prolonged traumatic action on the surfaces of the spinal articulations, their articular bands and ligaments, which become relaxed. This produces pressure upon the spinal roots of different cervical sectors, and with time, deposition of calcium within the spinal articulations. This new bone formation is significant, and frequently the patient complains of a burning sensation of the posterior part of the tongue, soreness and a lump in the throat, and difficulty in swallowing solid foods associated with prickly pain extending to the lower border of the cricoid cartilage. The laryngeal mucosa is pale, the vocalis muscle is weak, and there are phonatory disturbances, such as vocal weakness and hoarseness defined as "syndrome sympatico-vocal." The therapy of this condition is briefly discussed.

Tribble<sup>14</sup> reports a case of sarcoidosis of the larynx in a Negro woman. Several granulomatous growths removed from the vocal cords established the diagnosis. Sarcoidosis is a protean disease which must be distinguished from histoplasmosis and tuberculosis. The condition was treated with prednisone, the patient receiving from 20 to 30 mg. in divided doses daily for three months. This resulted in disappearance of the laryngeal lesions, but they later recurred in spite of therapy.

Cracovaner<sup>15</sup> points out that management of hyperkeratosis of the larynx is extremely difficult because some of these lesions are considered precancerous. The changes taking place are unrecognizable by visual examination. The definite diagnosis depends upon the microscopic findings, and this metamorphosis may take place at any time.

Hyperkeratosis may be localized or diffuse in the larynx; also termed keratosis, leukoplakia or pachydermia, it is a thickening of the layers of the epithelium, especially the corni-

fied portion, and may be slightly raised, rather dense and thickened, or it may be a greyish white sessile growth or a red thickening of the cord. It may also appear as a white, warty growth with sharp, spiny protuberances.

The condition in general is due to chronic irritation, such as from excessive smoking, overindulgence in alcohol, abuse of the voice, inhalation of fumes and dust or chronic infection of the upper respiratory tract. If the lesion is small and not too thick, the condition may subside simply by elimination of all causes of irritation; however, more frequently these areas have to be removed surgically by direct laryngoscopy, suspension laryngoscopy and stripping, or laryngofissure. One should be reluctant to perform laryngectomy even if the lesions are extensive unless proved malignant, because they are usually superficial and non-infiltrating. In such cases radiation therapy is the first choice. If the disease involves both cords and crosses the anterior commissure, stripping the involved areas, eliminating irritating causes and close observation are indicated. If malignant changes occur, laryngectomy becomes necessary.

Siegler<sup>16</sup> reports a case of leukoplakia of the larynx complicated by carcinoma. It is generally agreed by laryngologists that persistent leukoplakia on a vocal cord will eventually become malignant unless removed before the degeneration occurs. From 1954 to 1957 Siegler observed a patient with leukoplakia of one vocal cord which had a clinical appearance of carcinoma. Repeated biopsies from a bulky mass of hyperkeratosis were reported to yield negative results. The clinical appearance so simulated a malignant tumor that extensive radiation was administered with complete disappearance of the keratotic mass in 1955. As usual after irradiation, there was considerable edema of the laryngeal structures until October, 1956, when the edema disappeared and the cords appeared normal. In April, 1957, hoarseness and leukoplakia recurred with extensive involvement, and biopsy showed squamous cell carcinoma. One wonders whether early surgical removal would have prevented laryngectomy.

Priest<sup>17</sup> presents an excellent open-minded discussion of the

treatment of recurrent severe keratosis or leukoplakia. The article does not include a review of a large series of cases, but it contains the thoughts of a keen clinician regarding this problem. Various clinical sequences are presented. Priest favors roentgenotherapy in these cases from the standpoint of cure, arrest, or slowing the eventual development of malignant degeneration as contrasted with the delayed healing effect of roentgenotherapy with fistulous formation in patients who are later subjected to radical surgical procedures.

Lester and associates<sup>18</sup> are convinced that the diagnosis of primary laryngeal blastomycosis is extremely difficult to make, and the condition is frequently confused with tuberculosis and carcinoma of the larynx. This is exemplified by a case which they report in detail. From a thorough review of the literature they believe it represents the thirteenth case of blastomycosis of the larynx to be reported. The diagnosis was difficult to establish because the laryngeal lesion resembled tuberculosis, but the patient failed to respond favorably to tuberculous therapy; however, once the diagnosis was established, the patient was given 225 mg. of 2-hydroxystilbamidine daily, administered intravenously, for 30 days. Thereafter, improvement was rapid, and lost weight was regained. The appearance of the laryngeal lesion is fully described.

King and Cline<sup>19</sup> report a typical case of disseminated histoplasmosis with laryngeal lesions. They believe that the larynx is involved with this disease much oftener than current reports would indicate. Granulomatous lesions of the larynx should be suspected to be histoplasmosis even if the reaction to the histoplasmin skin test is negative. A definite diagnosis should be established by biopsy and culture. No drug has yet proved effective in the treatment of this disease, although ethyl vanillate has shown some promise. Laboratory results from use of amphatericin B have been encouraging, but use of this drug was unsuccessful in the case reported by King and Cline.

In a study of executive's dysphonia Gardner<sup>20</sup> reminds us that strain and tension are widely recognized as affecting functions of the human nervous system. He continues: "Com-

munication by speech is a synthesis of functions whose finely balanced co-ordinations are easily disturbed by stimuli from the autonomic and sympathetic nervous systems. The business executive is exceptionally vulnerable to the development of functional vocal disorders. His work is accomplished by . . . dictation, conferences, conversations by telephone—and the strain and tension are inherent threats to his position of commanding or supervising other personnel, and even to his survival in today's highly competitive commercial enterprises." Gardner reports the results of a study of 49 executives having functional vocal disorders, most of whom suffered from functional dysphonia. Those treated by proper voice therapy responded in excellent fashion, whereas those who did not accept voice therapy remained unimproved. In addition, other forms of treatment advised included antihistaminics, hypoallergenic diet, vitamins, tranquilizers or sedatives, heat, massage, and general relaxation.

Considerable attention has recently been focused on visceral manifestations of rheumatoid disease. Gresham and Kellaway<sup>21</sup> report a case of a woman with severe rheumatoid disease admitted to the hospital because of respiratory distress with complete fixation of the left cord in adduction and almost complete fixation of the right cord. She died suddenly without tracheotomy. Sections of the larynx showed typical rheumatic involvement of the cricoarytenoid joint.

They report another case of a man brought in dead after having suddenly collapsed. He was known to have had rheumatoid arthritis for 21 years, and the lungs and heart showed severe evidence of rheumatoid disease. The pathology of rheumatoid arthritis of the larynx and arytenoid cartilages is discussed.

#### PHARYNGEAL STRIDOR.

Russo and Coin<sup>22</sup> readily admit the laryngeal stridor in an infant may be due to many congenital or acquired conditions. They report a case of an infant with laryngeal stridor, which they attributed to calcification of the hyoid, thyroid and tracheal cartilages. They dismissed the laryngeal examina-

tion with the statement that it was "negative." They fail to mention the status of the epiglottis, the corniculate and cuneiform cartilages or the appearance of the mucosa covering the arytenoid area, all of which are vitally important in the evaluation of laryngeal stridor. Little information on the results of examination seven years later is given to compare with the condition found in the first year. The diagnosis was chondrodystrophy calcificans congenita, a condition which rarely occurs in the larynx.

#### STENOSIS.

In an excellent and lengthy article Holinger and Johnston<sup>23</sup> discuss their methods of management of chronic laryngeal stenosis. This condition is usually associated with a distressing degree of disability. Physical impairment ranges from respiratory effort, stridor, and even chronic anoxemia, to actual acute obstruction necessitating tracheotomy. Holinger and Johnston state that formerly diphtheria was the greatest causative factor in producing laryngeal stenosis, but trauma is rapidly replacing acute laryngeal diseases as the commonest cause of chronic laryngeal stenosis. Treatment is well described and illustrated by numerous photographs. The importance of maintaining a low tracheotomy is stressed, and in traumatic cases it is essential that reparative procedures be instituted within the first few days after the accident, before the cartilages have become fixed in their compressed or obstructing position and before scar tissue forms. This article is based on experience gained in a series of 163 cases of chronic laryngeal stenosis treated during the past ten years. This is good reading for all who are interested in this phase of laryngology.

#### SPASM.

Fogel and Hinderer<sup>24</sup> state that laryngospasm has been recognized as a possible but rare complication of electroconvulsive therapy. It was concluded after extensive studies that laryngospasm of varying intensity and duration occurs during the apneic phase of every electroconvulsive treatment in the unmedicated patient. Succinylcholine chloride ef-

fectively combats spastic closure of the glottis. Injection of 1 cc. of a one per cent solution of Pontocaine directly through the cricothyroid membrane is usually successful in stimulating a powerful reflex. These and many other suggestions are offered to combat a condition, which, unless relieved promptly may produce serious consequences.

#### LARYNGOCELE.

In a most interesting and informative article, Lane and associates<sup>25</sup> tell us that Virchow first described a laryngocele as a cystic dilatation of the sacculus or appendix of the ventricle of Morgagni. Larrey observed that many of the men reciting prayers from the temple minarets were afflicted with tumors of the neck. Later it was determined that abnormal increase of the intralaryngeal air pressure, such as in coughing, singing, playing wind instruments and glass blowing, distends the sacculus producing a laryngocele. To the 96 cases of laryngocele reported in the literature Lane and associates add a case of internal-external laryngocele. The surgical technique for correction of this lesion is well described. When removed, the sac measured 7 by 4 cm., and the patient made an uneventful recovery.

Sabri<sup>26</sup> reports a case of a combined internal-external laryngocele which was successfully removed by the one stage surgical procedure first suggested by O'Keefe. The laryngocele, which measured 5 by 2 cm. was hour-glass shaped.

Burke and Golden<sup>27</sup> report a case of external ventricular laryngocele and review the literature on this subject. They estimate that about 80 cases have been reported, although few of these appeared in the radiologic literature. Laryngoceles have been classified into internal, external or a combination of these. The roentgenographic appearance of these lesions is so classic that they present no problem in differential diagnosis. Bronchial cleft cysts, enlarged lymph nodes and laryngeal tumors are easily eliminated. Lateral pharyngeal diverticula may present a similar roentgenographic picture but are higher and usually smaller.

## FOREIGN BODY.

Spector<sup>28</sup> and Bautista report a case of an open safety pin lying in the trachea lodged between the vocal cords of a boy nine-months-old. This foreign body had remained in place for almost ten days because the parents gave no history of foreign body inhalation. It was discovered on routine roentgenography after the infant was admitted to the hospital. The case is presented to emphasize the fact that the possibility of foreign body must be considered in children in whom symptoms referable to the respiratory tract develop.

## PARALYSIS.

Laryngeal paralysis after spontaneous pneumothorax rarely occurs. Such a phenomenon has occasionally been observed after artificial pneumothorax. Palmer and Gupta<sup>29</sup> report a case of a patient experiencing simultaneously spontaneous pneumothorax and left recurrent laryngeal paralysis. Two possible explanations offered for this are damage to the nerve due to a slight and subclinical mediastinal shift and ischemic injury to the nerve.

Marin<sup>30</sup> presents a contribution to the surgical management of laryngeal paralysis after thyroidectomy, which is rather difficult to understand in spite of reading and re-reading. The presentation has probably suffered by translation. Marin is principally concerned with unilateral paralysis after thyroidectomy with fixation of the cord away from the median line, resulting in poor vocal function. Apparently the contribution offered by Marin has not been proved by trial and error and simply represents a theory, for he states, "we have imagined a procedure of cordal autoplasty formed of the following stages." He suggested making an incision in the thyroid cartilage, creating a window at the level of the paralyzed cord and inserting a piece of cartilage from the superior portion of thyroid into the window, forcing the paralyzed cord toward the median line and thereby closing the space between the cords with resultant improvement in phonation. No cases are reported, because there were none to report. There may



be merit to the theory, but until successful cases are reported it still remains just a theory.

The Semon lecture for 1957 was delivered by Capps,<sup>31</sup> who talked on abductor paralysis in theory and practice since Semon. This excellent, comprehensive article comments on the statement made by Semon "That in all progressive organic lesions of the centres or trunks of motor laryngeal nerves the abductors of the vocal cords succumb much earlier than the adductors." A diversity of opinion still exists relative to this statement. Experimental works of, and reports by, laryngologists are quoted freely, and the anatomy and functions of the superior and recurrent laryngeal nerves are discussed. The causes of unilateral and bilateral abductor paralysis are reviewed and the methods of treatment considered. This is an excellent and informative article on a controversial subject.

Chiong and Gorman<sup>32</sup> report 15 cases of bilateral abductor paralysis of the vocal cords after thyroidectomy which were corrected by external arytenoidectomy. All were females. The technique used was the Woodman modification of the Kelly operation, which is adequately described. Results were successful with a good airway and a fair voice in all patients.

In a lengthy discussion of vocal rehabilitation of paralytic dysphonia Arnold<sup>33</sup> emphatically states that paralytic dysphonia depends on several specific factors which he enumerates. The type and degree of vocal disability due to laryngeal paralysis are extremely variable. He discusses the various types of paralysis, and much consideration is given the median and paramedian positions of the paralyzed vocal cord. In an analysis of the phonetic signs of paralytic dysphonia the single vocal qualities are discussed and followed through the five stages outlined in the discussion of laryngeal paralysis. This most excellent paper must be read and reread to be fully appreciated.

#### INSTRUMENTS.

Lewy<sup>34</sup> presents a revision of the "one side open" laryngoscope originally described by Bruening, Mosher, Ingals and

others. This revised edition is much lighter, and the blade of the laryngoscope probably is a little longer for better visualization of the anterior commissure.

Gross<sup>35</sup> describes an illuminated laryngoscopic speculum for use on small animals. It is self-retaining and combines the function of mouth gag and tongue depressor. With the speculum in position the vocal cords are easily visualized, and intratracheal manipulations are readily accomplished.

Bizzarri and Giuffrida<sup>36</sup> designed a laryngoscope blade which they believe is superior to the MacIntosh laryngoscope. It does not have a vertical component, which they have found interferes with performance of laryngoscopy, particularly in patients with deformities of the head and neck.

Miles Foxen<sup>37</sup> presents a modification of the usual types of intratracheal tubes used by the anesthetist. Because of the possibility of detaching fragments of tumor and the implantation of malignant cells in the tracheobronchial tree, he designed a new type of intratracheal tube having a rounded tip and two small cuffs which he claims will produce less trauma in malignant tumors of the larynx.

#### ANESTHETIZATION.

Young<sup>38</sup> lists the conditions required during direct laryngoscopy and minor operations on the larynx as anesthesia readily terminated to minimize postoperative aspiration of blood or debris; complete relaxation of the jaw and cords, quickly reversible to allow assessment of the function of these latter; maintenance of airway even past fallen tongue and stenosed larynx; maintenance of tidal exchange even when positive pressure cannot be applied, and freedom from explosion.

To meet these requirements Young gave minimal barbiturates intravenously. Through an indwelling needle the patient was paralyzed by administration of a short acting relaxant. A thin polythene or other catheter was then passed through the mouth and glottis to the carina, and then connected to a source of oxygen. Further doses of relaxant were then given

as required. Cardiac irregularities occur but apparently have caused no concern.

Wolfson<sup>39</sup> presents a most interesting discussion of major and minor laryngeal sequelae of endotracheal intubation. Major complications are uncommon. The most commonly reported laryngeal complication of intubation is formation of granulomas. Usually these occur at the vocal process where the mucoperichondrium covering this area is extremely thin. Frequently, it is necessary to remove these granulomas surgically. Wolfson quotes various authors who have reported complications. The minor complications consist of post-intubation sore throat, laryngitis and tracheitis, which all respond favorably to proper therapy.

Barton<sup>40</sup> believes that the fact that laryngeal granuloma may occasionally occur as a sequel to endotracheal intubation in no way invalidates the many advantages of this technique of induction of anesthesia; nevertheless, claims of negligence with resultant law suits are sometimes filed, even when the patient has completely recovered from such a granuloma.

The etiology of these granulomas is discussed. Barton believes that the proper method to handle these lesions is to allow a well defined pedicle to develop, after which self amputation will follow. Although this is an excellent method, it frequently requires many months for the pedicle to form, and in the interim the patient is extremely hoarse. We have obtained excellent results by surgical removal. Barton is of the opinion that litigation over laryngeal granulomas due to intubation could be avoided if the anesthesiologist would see the patient before and after operation to evaluate his condition and to discuss possible complications with him. He believes that the laryngologist can help by judicious treatment and by explaining to the patient that development of these granulomas does not signify negligence.

Total or partial removal of the larynx is seldom performed in a general hospital; consequently, few anesthesiologists have wide experience with the problems and complications encountered in anesthetizing patients for this type of operation, according to Boyan and Howland,<sup>41</sup> who present an excellent

article on induction of anesthesia for laryngectomy. In the preparation of this article they reviewed the management of anesthetization of 1000 patients subjected to laryngectomy. The main concern of the anesthesiologist during laryngectomy is to maintain an unobstructed airway at all times. This is not always easy, as the growth within the larynx may interfere with the airway; and the surgeon, working as he must on the airway, adds to the worries of the anesthesiologist. The technique of inducing such anesthesia and the complications that might occur are discussed. It is regrettable, however, that they did not discuss the possibilities of transplanting a piece of fragile carcinomatous tissue by the passage of a tube through the larynx into the lower trachea.

Baillie and associates<sup>42</sup> report their experiences with induced hypothermia in five patients having major surgical procedures on the larynx. The procedure considered for induced hypothermia was pharyngolaryngeal resection with block dissection as required and one stage reconstruction when possible. Preoperative assessment was necessary in each patient. The technique of anesthetization is well described. Use of hypothermia in these five patients was highly successful. Recovery from anesthesia and restoration of protective reflexes were rapid, and postoperative vomiting did not occur; however, these authors point out the danger of induced hypothermia, and they have been impressed by the excellent condition of the patients during and after the extensive operations performed.

Hirzel<sup>43</sup> notes that early in surgical training, stress is placed on avoidance of injury to the inferior laryngeal nerve, but no emphasis is placed on avoiding injury to the superior laryngeal nerve. If the entire superior laryngeal nerve is traumatized, deglutition, especially of liquids, is disturbed, and a persistent cough, shallow voice and fatiguing speech will result. Trauma of the internal branch alone results in persistent post deglutition cough, but speech is normal. Injury to the external branch results in a shallow voice which is easily fatigued, but there is no cough.

Eight cases are reported of injury to one or the other

branches or to the common nerve with symptoms. Injury to this nerve should be stressed more in texts and surgical teaching.

Schobinger<sup>44</sup> showed that spasm of the cricopharyngeal muscle after laryngectomy is frequently the cause of dysphagia. He was able to obtain definite roentgenographic evidence of spasm of the cricopharyngeal muscle in a number of patients. Symptoms ranged from mild discomfort to severe dysphagia. Repeated esophageal dilations corrected the condition in some, and in others administration of a short-acting curare-like agent provided relief.

Graham and associates<sup>45</sup> discuss the importance of removal of accumulated secretions from the tracheobronchial tree throughout the entire postoperative period. If the patient cannot adequately eliminate these by coughing, he must be assisted by pharmacologic, physical and mechanical means or a combination of these.

Bronchial secretions arise from goblet cells and tuboalveolar glands. The thinner covers the membrane; the thicker faces the bronchial lumen. This blanket of bronchial secretions is moved continuously from the smaller bronchioles to the larynx. This is motivated by ciliary action, bronchial peristalsis, changes in bronchial contour and cough. Bronchial plugging is due to a combination of factors in the postoperative period. These are diminished bronchial calibre due to spasm and edema of the membrane, reduced respiratory excursion, ineffective effort to cough when coughing is painful, depression of ciliary activity and bronchial peristalsis, and excessive tenacious secretions.

Preventive treatment consists of avoidance of operation in elective cases in the face of infection in the upper respiratory tract; abstinence from tobacco for two weeks before operation in heavy smokers; bronchial cleansing for three days preoperatively with bronchial dilators, such as epinephrine or similar products as nebulizers, linguets or suppositories; detergents as Alevair and Tergemist, and humidification.

Postoperative endoscopy with the tracheal catheter, and when this fails, the bronchoscope, may be helpful. Tracheotomy under certain conditions may be lifesaving in removing secretions. The patient should be educated preoperatively to cough so that a well established cough mechanism is maintained postoperatively.

Norris<sup>46</sup> describes a new surgical procedure designated as "fronto-lateral partial laryngectomy." The indications for this procedure are those few lesions thought to be slightly too extensive for the laryngofissure operation and yet not sufficiently extensive to warrant total laryngectomy. The technique is adequately described in steps with illustrations, and 16 cases are reported. Although this technique has much merit, it is thought that the judicious selection of proper cases for its use poses a problem for all but the experienced laryngologist.

In an interesting article Cowan and McDougall<sup>47</sup> report nine cases of reconstruction of the pharynx after laryngopharyngo-esophagectomy successfully accomplished by their technique. In the treatment of carcinoma of the hypopharynx and extrinsic larynx they advocate excising the pharynx, larynx and cervical esophagus combined with hemithyroidectomy and radical neck dissection on the side of the neck over which the primary lesion centers. This creates a defect in the continuity of the pharynx from above the level of the hyoid bone to the lower cervical esophagus. The problem presented is closure of the defect, and the nine cases reported illustrate the technique employed in obtaining closure.

In discussing the factors which might contribute to the success or failure of the rehabilitation of the laryngectomized patient, Stoll<sup>48</sup> agrees with Schall that the psychological attitude of the patient plays a dominant role. The anxiety of the patient indicates the need for psychological adjustment, and when these factors are controlled, rehabilitation will be achieved more readily.

In a survey of 440 laryngectomized patients Putney<sup>49</sup> found that a useful buccal voice had failed to develop in 166. No underlying anatomic or physiologic factor was found to ac-

count for this failure, and patients with extensive surgical procedures including radical neck dissection were able to talk expertly. A disturbance of the musculature of the tongue and floor of the mouth presented problems in swallowing and phonating. Putney emphasizes that the primary object in treatment of carcinoma of the larynx is complete eradication of the lesion, and this should be carried out regardless of the sacrifice of tissue and heedless of the subsequent development of a voice. Failure to develop a voice after laryngectomy is attributed to lack of energy, fortitude or desire to learn a new method.

Norris<sup>50</sup> discusses the deformities, complications and disabilities resulting from laryngectomy with or without neck dissection. These depend entirely on the extent of the surgical excision necessary to eradicate the malignant lesion. Section of the spinal accessory nerves will always result in loss of trapezius function, and stenosis of the tracheal stoma, hypopharynx and esophagus always presents problems. The management of these and other conditions is clearly and concisely discussed.

Moses<sup>51</sup> is of the opinion that the voice of the laryngectomized patient has been much discussed, but the part of the voice therapist in the rehabilitation of the patient has never been outlined. He, therefore, discusses the qualifications that are desirable in such teachers. There is much need for psychological guidance for the laryngectomized patient, and the vocal therapist occupies a position in which such therapy can be properly dispensed. Moses expresses his interest in the technique of teaching the esophageal voice and who should provide voice therapy. The ideal treatment will be the joined forces of surgeons and medical therapists who are able to do more than just teach the patient to belch esthetically.

Conley and associates<sup>52</sup> present a new surgical technique for vocal improvement of the laryngectomized patient. This cleverly conceived operative procedure consists of creating a tunnel through the wall of the cervical esophagus and thereby establishing a controlled communication between the trachea and the esophagus. This tunnel may be constructed



of esophageal mucosa or a properly selected vein graft. The latter is much easier to use than esophageal mucosa. This tube is constructed in such a manner that air can pass into the esophagus without the disadvantage of food and saliva passing onto the neck or into the trachea. This intriguing procedure was performed on 15 patients with only minor complications. The authors believe that their results warrant further investigation of this procedure, which facilitates development of esophageal speech.

In discussing the functions of the larynx Bautista<sup>53</sup> states that phonation is a purely social function. Loss of the larynx thus produces a grave psychosocial crisis the significance of which can be fully appreciated if we thoroughly understand the primary place that communication holds in our psychologic and social health. Rehabilitation of the laryngectomee should start approximately two weeks after operation if complete healing has occurred. Bautista discusses the several methods of teaching new speech as advocated by speech therapists, and concludes that the esophageal voice remains superior to other types.

Approximately one-third of all laryngectomized patients find it impossible, for one reason or another, to master esophageal speech. These patients are in dire need of some type of artificial larynx in order to communicate vocally. Barney<sup>54</sup> discusses the requirements of an ideal artificial larynx. He believes that with the tremendous advances in electronics an acceptable artificial larynx will soon be developed. Currently available speech aids are not too satisfactory, and with improved surgical techniques, plus the help of electronics, the ideal will be achieved.

Struben and Gelder<sup>55</sup> emphasize the fact that closure of the nasopharynx by action of the soft palate is essential for good intelligible speech. It is necessary for the laryngectomized patient to make optimum use of the available volume of air collected in the upper portion of the esophagus. The patient will start by closing the nasopharynx, as only in this way will he be able to bring air into the upper esophagus. The nasopharynx opens for a very short time only to pronounce the

nasal sound and immediately closes again to prevent unnecessary loss of air. In order to obtain a clear voice and intelligible speech an excellent functioning of the mechanism of the upper esophagus with pseudoglottis is necessary.

#### BENIGN TUMORS.

Multiple papillomatosis of the larynx remains one of the most vexing problems facing laryngologists today. Pinsker and Proud<sup>56</sup> conducted studies which made them agree with the opinion expressed by virologists that the various papillomas that plague mankind are caused by similar, if not identical, viruses. This virus etiology of laryngeal papillomas was established by Ullman in 1923. Several definite characteristics of the papilloma virus are recognized, and others are presumed. This virus is infectious, but to a slow degree. It stimulates an antibody response over an extended period of time. The major reaction of the infected individual is local. This would certainly explain the extended course of the disease for many years, and finally the spontaneous remission, which is most frequently the outcome. Pinsker and Proud believe that topical application of podophyllin is beneficial when multiple papillomas are removed surgically, although we question its value.

Winston and Epstein<sup>57</sup> made a systematic study of benign laryngeal tumors based on recent material seen at the Royal National Throat, Nose and Ear Hospital in London. In this, the third and final part of the study, they record the incidence of the condition and assess its clinicopathologic implications with particular reference to the problem of malignant change. They found that the papilloma was the commonest benign laryngeal neoplasm. Of 39 cases encountered between 1948 and 1957, eight were in children and 31 in adults. Their cases substantiate the observation of others that the evidence for the alleged regression of these neoplasms at puberty is tenuous. They believe that the importance of diet as an etiologic factor has been underestimated. Prophylactic tracheotomy is advocated in an attempt to prevent fatal asphyxia in children with laryngeal papillomas, which they point out is a real possibility. The importance of careful assessment

of the histology of adult papillomas in order to detect malignant changes early is emphasized. Such changes occurred in one of their 39 cases.

Hinton and Weinberger<sup>58</sup> report a case of granular cell myoblastoma of the larynx found while investigating the complaint of hoarseness due to vocal nodules. At that time a nodular mass was seen on the superior surface of the left ventricular band and biopsy established the diagnosis. When completely removed, granular cell myoblastoma of the larynx seems to have little predilection for recurrence. The exact origin of this type of tumor remains obscure.

Campbell and associates<sup>59</sup> present five cases of congenital subglottic hemangioma and review 14 previously reported cases. All 19 patients were younger than one year old and showed evidence of laryngeal obstruction, which was usually episodic and sufficiently severe to require tracheotomy. The diagnosis was made in most cases by detection of subglottic stenosis by roentgenographic, laryngoscopic or bronchoscopic examinations. Noisy respiration or wheezing, episodes of severe dyspnea and stridor, working of accessory muscles, sternal retraction and cyanosis should suggest the possibility of congenital subglottic hemangioma. Tracheotomy should be done early. Roentgenotherapy produced clinical improvement in four of the five cases in which it was used. This is an excellent and illuminating article which should be read by all laryngologists, as too often we fail to consider subglottic hemangiomas as possible factors in laryngeal obstruction.

Som<sup>60</sup> reports an interesting case of a 47-year-old man who complained of hoarseness of one month's duration. On indirect laryngoscopy a broad based mass was seen attached to the left arytenoid, covered by intact mucosa. The pyriform fossa was obliterated, but motility of the vocal cords was not impaired and there was no cervical adenopathy. Tomography of the larynx demonstrated a soft tissue mass occluding the left pyriform fossa and involving the left arytenoid region. The true and false cords were displaced medially, and the ventricle was obliterated.

Lateral pharyngotomy was performed, and the tumor was

removed. Eight months later the patient returned with practically the same findings as originally. A more radical operation was employed, and not only was the tumor removed, but the major portion of the epiglottis was also removed in continuity. The diagnosis was neurofibroma of the larynx.

Handousa and Elwi<sup>61</sup> describe scleroma as a disease characterized by chronic specific inflammatory lesions of the upper respiratory tract. Their studies of the histopathology of scleroma are interesting. They are of the opinion that the vacuolated or foamy appearance of Mickulicz cells is due to hydropic degeneration. It is well known that the diffuse or nodular form of scleroma is usually bilateral. The authors, however, report cases of scleroma which were manifested by a single large mass like a tumor. Laryngeal scleroma, according to Handousa and Elwi, is almost always secondary to nasal scleroma. The site of choice is in the "subglottic region" and eventually a fibrous stricture forms. Unilateral involvement of the ventricle and thickening and fixation of one cord are seen occasionally with or without a granuloma. The clinical appearance of these cases closely simulates malignant disease.

The encountering of a thyroid tumor in the larynx and trachea of one of his patients prompted Waggoner<sup>62</sup> to review the embryology and theories of pathogenesis. He concluded that non-malignant thyroid tissue found inside of the larynx or trachea must arise by direct extension from the thyroid gland or from deposits of thyroid tissue early in embryonic development. Development of obstruction of the airway will depend upon the size of the tumor, which is usually located on the posterior wall, and suspicion that the tumor is thyroid tissue is strengthened if an external goiter is present. Surgical removal is indicated. Waggoner points out that intralaryngotracheal goiter, although rare, should be kept in mind when making a diagnosis of intralaryngeal tumors. A tracer study with radioactive iodine is an important adjunct to diagnosis and will frequently help direct the proper course of treatment.

Pickard<sup>63</sup> reports two cases in which leiomyomas of the

larynx occurred in close proximity to the airway. He stated that the tumors arose from and were formed of the fusiform nucleated cells of involuntary muscle. He was able to find only one report of a leiomyoma in the trachea in the literature, and of 106 benign tumors of the larynx at King's College Hospital, only one was a leiomyoma.

#### MALIGNANT TUMORS.

In a most excellent monograph on clinical and surgical problems of cancer of the larynx and hypopharynx, Pietrantonio and Fior<sup>64</sup> analyze the different aspects of this problem. Greatest importance is given to classification according to stage and site. Tobacco and alcohol are considered etiologic factors, and a study of 200 cases showed that smoking might well be considered as a possible cancerogenetic factor. Only a local irritative action may be attributed to alcohol, as shown by the prevalence of pharyngolaryngeal tumors in the group of heavy drinkers. The higher clinical malignant growth of poorly differentiated and basal cell carcinomas is stressed; these should be treated with radical excision combined with elective neck dissection. Hypopharyngeal cancer is much more frequent in Great Britain, France and Scandinavia than in Italy. The prognosis is better in women than in men. Pietrantonio and Fior state that laryngectomy with combined neck dissection shows no higher operative risks than laryngectomy alone, and to prevent shoulder drop and other undesirable sequela, the spinal accessory nerve is dissected free when possible. They believe that every surgical technique will give satisfactory results, providing they have a well defined anatomic foundation, permit total removal of the tumor, and postoperative complications are held to a minimum. Hemilaryngectomies have been abandoned in the belief that laryngectomies offer greater chance of survival. Irradiation therapy after laryngectomy is advocated. The curability of laryngeal carcinoma depends largely on whether cervical metastasis is present. This article represents one of the best reviewed this year and should be thoroughly read to be appreciated.

Work<sup>65</sup> classifies cancer of the larynx and pharynx ac-

cording to the International Radiological Congress' proposals made in Copenhagen in 1953 into cordal, supraglottic, subglottic, hypopharyngeal and postcricoid. Size, presence of edema, surface growth and deep ulceration, as well as grading in stages from I to IV, may be of further assistance in classification. The diagnosis can usually be made by biopsy and microscopic examination. Papanicolaou's stain of extruded cells, tomography, contrast roentgenography and palpation are other aids in establishing the diagnosis. Surgical removal and radiation are the only two forms of therapy available today for the treatment of cancer of the larynx. The classification of the lesion, its site, type and extent, and the indicated therapy are given.

Barretto<sup>66</sup> presents suggestions for the nomenclature and classification by staging of malignant tumors of the larynx and hypopharynx. There has been an urgent need for a uniform nomenclature and staging of malignant tumors of the larynx, and this presentation by Barretto shows that much effort has been directed toward an attempt to present a plan that could be universally accepted. The very fact that a nationally recognized group has recently appointed a committee to study and present suggestions and plans on this subject proves that no plan has as yet been accepted by laryngologists. Work such as Barretto has presented will undoubtedly contribute much help to the newly formed committee.

Hall<sup>67</sup> correctly states that sarcoma of the larynx is a rare condition, occurring in from 0.5 to 1 per cent of all malignant laryngeal tumors. Such a case is reported involving the entire right vocal cord, and on histologic examination of a specimen obtained at biopsy, a spindle cell sarcoma was noted. These tumors have a tendency to be smooth and possibly lobulated, and do not ulcerate in the early stages. Metastasis occurs late. The prognosis is probably more favorable than is that of carcinoma of the larynx. In the case reported, the early results of radiation therapy appeared to be excellent; but recurrence was early and rapid, and the thought is expressed that surgical removal is the most effective treatment.

Seyfried<sup>68</sup> believes that selection of therapy in carcinoma

of the larynx is best arrived at by the combined efforts of the radiologist and the laryngologist. We do not agree with his statement that the laryngologist cannot make an accurate diagnosis of cancer of the larynx without the help of the radiologist. Seyfried states that glottic tumors involving only one cord and without impairment of mobility were formerly treated by laryngofissure. He offers no reports of cases to substantiate his statement that these lesions will now regress completely with fractional Roentgen-ray therapy. He points out that laryngofissure can now be employed to remove tumors of wider extent if associated with an inflammatory process, or if recurrent. The indications for the laryngofissure operation are well outlined. Extensive tumors as a rule will not respond favorably to such a conservative procedure, and the same applies to recurrences after initial Roentgen-ray therapy. There are many controversial problems in this article and many that are unacceptable to the reviewers.

Sarma<sup>69</sup> presents a study of the incidence and etiology of cancer of the larynx in Assam, the easternmost state of India. It is astounding to read that during the period from October, 1948, to December, 1951, 351 cases of cancer were diagnosed at the Assam Medical College Hospital, of which 186 were in the larynx, an incidence of 50 per cent. A survey conducted from January, 1954, to March, 1955, showed 238 cases of cancer of the upper alimentary tract, as against 84 cases in other parts of the body. Of these, 108 were found in the larynx. In Assam, of 220 cases of cancer of the larynx reported, 217 were extrinsic and only three intrinsic. Sarma attributes the high incidence of carcinoma of the larynx in Assam to the prevalence of chewing the betal-nut, which produces violent irritation of the pharyngeal mucosa, particularly in the region of the pyriform fossa.

Putney<sup>70</sup> states that when carcinoma attacks portions of the larynx other than the vocal cords, metastasis to the regional lymph nodes occurs frequently. Recognition of this fact and performance of block dissection of the neck may help prevent loss of life from undetected lymphatic metastasis. In this most excellent article, Putney reports that in 223 cases of carcinoma of the larynx in which 236 dissections of the



neck were performed, the incidence of carcinoma in the cervical lymph nodes was 56 per cent. The highest percentage of regional lymph node metastasis occurred in extensive laryngeal lesions or those involving the arytenoid, aryepiglottic fold, pyriform fossa or vallecula. Preventive dissection of the neck was performed in 62 patients with no palpable lymph nodes, in 16 (26 per cent) of whom cancer was histologically present in the excised lymph nodes. Putney rightfully concludes that dissection of the neck at the time of laryngectomy, in patients with laryngeal carcinoma involving areas besides the vocal cords, will result in more five-year survivals. The curability of cancer is highest when there is no metastasis, less with microscopic metastasis and least when palpable metastatic glands are present. All interested in carcinoma of the larynx should read this article in its entirety.

Rubenstein and associates<sup>71</sup> report two cases of carcinoma of the larynx associated with carcinoma of the bronchus. They emphasize the fact that patients who have carcinoma of the larynx should be observed carefully for the appearance of carcinoma of the lung. Multiple primary neoplasms are by no means rare. Warren and Gates are cited as considering the tendency for a second cancer to develop in a person to be 11 times greater than that of the patient who has never had cancer. When two carcinomas are discovered simultaneously, the more lethal lesion should be attacked first.

In carcinoma of the epiglottis Ogura<sup>72</sup> wonders whether the tremendous sacrifice of total laryngectomy with commission of the patient to permanent tracheostomy is entirely necessary. He points out that the aims of the surgeon are not only adequate removal of the lesion but also preservation of the laryngeal physiologic relationships. In an attempt to conserve the function of the larynx, supraglottic subtotal laryngectomy and radical neck dissection as a one-stage operation for carcinoma of the epiglottis was developed.

The 11 surgical criteria for this procedure are listed and the technique is described. Neck dissection is carried out on the same side as the growth, even in the absence of nodes.

Deglutition becomes a serious problem that requires time to master.

*En bloc* removal of the primary lesion together with radical neck dissection was performed on 15 patients. Early rehabilitation of the patient has been accomplished by reconstruction of the laryngopharynx by a muscle flap and skin graft. It is possible to preserve the function of the true cord.

Mitchell and Haybittle<sup>73</sup> made a study of the results of treatment of 130 cases of squamous carcinoma of the skin, 44 cases of carcinoma of the larynx, and 104 cases of carcinoma of the pharynx in an attempt to assess the dose levels to be used with radio-iridium,  $^{192}\text{Ir}$   $\gamma$ -ray therapy. The clinical results did not provide any conclusive evidence that in the treatment of carcinoma of the larynx and pharynx the use of a short distance X-ray therapy unit instead of the conventional Roentgen-ray apparatus leads to a higher cure rate.

Marchetta and co-authors<sup>74</sup> report their experiences with 270 cases of carcinoma of the extrinsic larynx. Of these patients, 241 were treated with radiation between 1935 and 1953; 63 had extrinsic cord lesions, 88 lesions of the epiglottis and 90 involvement of the arytenoid and aryepiglottic folds. At the end of 24 months, 78 per cent of the patients were dead of the disease, and 14 per cent showed no evidence of disease. After reviewing these results Marchetta and associates considered the treatment of choice to be surgical. Laryngectomy was performed on 14 patients and laryngectomy and neck dissection on 15 patients. Because of histologically positive nodes in 60 per cent of surgical specimens, total laryngectomy and radical neck dissection were adopted as basic therapy for all patients with carcinoma of the extrinsic larynx. The cure rate in the 29 patients who had radical surgical excision was 45 per cent; this is a definite improvement over former results.

Sixty-two intrinsic laryngeal carcinomas were removed through the thyrotomy approach, were serially sectioned and were examined by Multanen.<sup>75</sup> The following points were considered: metastasis, recurrence, rate of tumor growth, the patient's age and duration of survival after treatment.

In 12 of the 62 cases the histologic picture varied in different parts of the malignant tumor. Greater variations were noted in the posterior part than in the anterior part. In general, the degree of malignant degeneration was the same at the periphery as in the center. This study also substantiated the known fact that the more histologically malignant the lesion the greater the number of mitotic figures. Tumors that metastasized later showed originally a higher percentage of mitotic figures.

Comparison of tumors of the vocal cord with those of the ventricular band showed that those that metastasized later had the same increase in mitotic figures—in other words, a higher degree of malignant degeneration.

Carcinoma of the larynx is a disease of old people. Those younger than 50 years showed a higher degree of malignant growth than those older than 50.

Inflammatory cells are regarded as a typical feature of malignant growth. No conclusions could be drawn as to their effect on the cytology of cancer of the larynx.

Jesberg<sup>70</sup> expresses concern as to what happens to laryngectomized patients in whom the disease later extends to the cervical lymph nodes. Metastatic cervical lymph node disease develops in approximately 30 per cent of laryngectomized patients. Improvement could be expected by performing neck dissection at the time of laryngectomy, but the difficulty is in selecting the cases for such an extensive operation. Jesberg quotes a statistical report by Kuhn, who stated that 57 per cent of all non-cordal and diffuse growths were complicated by metastatic lymph node disease. The element of unpredictability in the biological behavior of these growths is impressive. One patient may have a bulky, primary, extra-cordal growth without metastasis, and another with a small cordal lesion may eventually manifest incurable metastatic disease. Jesberg discusses the clinical types of lymph node metastasis and reports two cases of contralateral metastasis after laryngectomy. In the discussion of contralateral metastasis, Willis offers a pathologic explanation based on the dis-

turbed dynamics of the lymphatic drainage system in the presence of neoplastic disease.

In an interesting article, Hladky and Sprindrich<sup>77</sup> compare the results of treatment of patients suffering from cancer of the larynx during the decade 1945 to 1954, with those obtained during the foregoing decade. Patients were treated with irradiation according to the Coutard technique, by surgical extirpation, or by both methods. Although Hladky and Sprindrich are enthusiastic about the results obtained with irradiation, this enthusiasm is not warranted, as the percentage of five and ten-year survival is much higher in patients treated surgically. Hladky and Sprindrich contend that the advantage of surgical treatment consists in its being independent of the varying degree of radiosensitivity of tumors, whereas successful irradiation depends entirely upon the sensitivity of neoplastic cells toward irradiation; therefore, frequent laryngoscopic examinations are imperative for all patients treated by irradiation.

Hagan<sup>78</sup> advocates prompt, aggressive surgical treatment in all operative cases of laryngopharyngeal cancer. Surgical resection of these tumors is not only feasible, but until better methods for the treatment of cancer are discovered, offers the best chance of obtaining a cure.

Fisher and Miller<sup>79</sup> present a ten year study of the histopathologic classification, prognosis and treatment of 48 cases of carcinoma *in situ* of the larynx. The average age of the 41 males was 55 years, and of the seven females, 44 years.

All were proved cases of carcinoma *in situ* histopathologically, without invasive carcinoma when the diagnosis was first made. There is no typical clinical change, leukoplakia being the most common; but one case showed typical vocal nodules, two cases exhibited polypoid changes of hypertrophic laryngitis, and three cases showed typical contact ulcer granulomas.

Histologically, there were three types: the squamous type, the basal type and the Bowenoid type. The squamous type was associated with leukoplakia; the basal type, with lesions

of the swollen injected variety without leukoplakia. When the clinical picture was mixed, the histological picture was also mixed.

The type of treatment depended on the extent of the lesion, method of original diagnosis, and development of recurrence.

Leukoplakic lesions were completely stripped for diagnosis. If the lesion was small and completely stripped, no further treatment was instituted. If residual or recurrent carcinoma was proved in the same lesion, laryngofissure operation was performed. If carcinoma *in situ* was found in extensive leukoplakia, complete stripping was performed. The non-leukoplakic lesions were handled in the same way, but more often extensive roentgenotherapy was employed.

Of the 16 patients treated by stripping only, invasive carcinoma developed in four later. Carcinoma has developed in none of the eight patients treated by laryngofissure. Invasion occurred in six of 24 patients who had roentgenotherapy.

#### REFERENCES.

1. TIMCKE, R.; VON LEDEN, H., and MOORE, P.: Laryngeal Vibrations; Measurements of the Glottic Wave. I. The Normal Vibratory Cycle. *Arch. Otolaryngol.*, 68:1-19, July, 1958.
2. MOORE, P., and VON LEDEN, H.: Dynamic Variations of the Vibratory Pattern in the Normal Larynx. *Fol. Phoniat.*, 10:205-238, 1958.
3. NAKAMURA, F.; UVEDA, Y., and SONODA, Y.: Electromyographic Study on Respiratory Movements of the Intrinsic Laryngeal Muscles. *THE LARYNGOSCOPE*, 68:109-119, Feb., 1958.
4. FURSTENBERG, A. C.: Evidence of Laryngeal Participation in Emotional Expression; Its Relation to Hysterical Aphonia. *Ann. Otol., Rhinol. and Laryngol.*, 67:516-527, June, 1958.
5. FAABORG-ANDERSEN, K., and EDELETT, A. W.: Electromyography of Intrinsic and Extrinsic Laryngeal Muscles During Silent Speech: Correlation with Reading Activity. *Acta Otolaryngol.*, 49:478-482, Nov.-Dec., 1958.
6. TSCHLIASSNY, K.: Necrophonia. *Arch. Otolaryngol.*, 67:643-648, June, 1958.
7. EPSTEIN, S. S.: A Stripping Technique for the Examination of the Total Epithelial Surface of the Larynx. *Jour. Path. and Bact.*, 75:472-473, April, 1958.
8. KEEN, J. A., and WAINWRIGHT, J.: Ossification of the Thyroid, Cricoid and Arytenoid Cartilages. *So. African Jour. Lab. and Clin. Med.*, 4:83-108, June, 1958.
9. TRIBOLETTI, E.: Unusual Congenital Anomaly Involving the Larynx,

Trachea and Esophagus. *New Eng. Jour. Med.*, 258:1002-1003, May 15, 1958.

10. SOXNINEN, A., and VAHERI, E.: A Case of Voice Disorder Due to Laryngeal Asymmetry and Treated by Surgical Medioposition of the Vocal Cord. *Fol. Phoniat.*, 10:193-199, 1958.

11. SILVERBLATT, B. L.: The Use of Antibiotic-Steroid Combinations as Nebulizing Agents in the Treatment of Laryngeal Conditions. *THE LARYNGOSCOPE*, 68:1081-1086, June, 1958.

12. MYERSON, M. C.: Vocal Rest in Laryngeal Disease. *Ann. Otol., Rhinol. and Laryngol.*, 67:491-495, June, 1958.

13. LASKIEWICZ, A.: Pharyngolaryngeal Disturbances Due to Cervical Spondylosis. *Arch. Otolaryngol.*, 67:292-301, March, 1958.

14. TRIBBLE, W. M.: Sarcoidosis of the Larynx. *Arch. Otolaryngol.*, 65:382-383, Sept., 1958.

15. CRACOVANER, A. J.: The Management of Hyperkeratosis of the Larynx. *THE LARYNGOSCOPE*, 68:1494-1505, Aug., 1958.

16. SIEGLER, J.: Leukoplakia of the Larynx Complicated by Carcinoma. *Jour. Laryngol. and Otol.*, 72:78-80, Jan., 1958.

17. PRIEST, R. E.: Controversial Aspects of the Treatment of Laryngeal Keratosis. *THE LARYNGOSCOPE*, 68:766-779, April, 1958.

18. LESTER, C. F.; CONRAD, F. G., and ATWELL, R. J.: Primary Laryngeal Blastomycosis; Review of the Literature and Presentation of a Case. *Amer. Jour. Med.*, 24:305-309, Feb., 1958.

19. KING, H. C., and CLINE, J. F.: Histoplasmosis Involving the Larynx. *Arch. Otolaryngol.*, 67:640-654, June, 1958.

20. GARDNER, W. H.: Executive's Dysphonia; a Study of 49 Patients. *Cleveland Clin. Quart.*, 25:177-186, July, 1958.

21. GRESHAM, G. A., and KELLAWAY, T. D.: Rheumatoid Disease in the Larynx and Lung. *Ann. Rheumat. Dis.*, 17:286-292, Sept., 1958.

22. RUSSO, P. E., and COIN, C. G.: Calcification of the Hyoid, Thyroid and Tracheal Cartilages in Infancy; Report of a Case. *Amer. Jour. Roentgenol.*, 80:440-442, Sept., 1958.

23. HOLINGER, P. H., and JOHNSTON, K. C.: The Management of Chronic Laryngeal Stenosis. *Ann. Otol., Rhinol. and Laryngol.*, 67:496-515, June, 1958.

24. FOGEL, E. J., and HINDERER, K. H.: Laryngospasm; Its Incidence and Management in Electro-Convulsive Treatment. *Dis. Nerv. System*, 19:61-65, Feb., 1958.

25. LANE, S. L.; COHEN, B., and IPPOLITO, C.: Co-existing Internal and External Laryngoceles. *Amer. Jour. Surg.*, 96:810-814, Dec., 1958.

26. SABBI, M. S.: Combined Internal-External Laryngocele Successfully Treated by a One-stage Surgical Procedure. *Arch. Otolaryngol.*, 68:761-763, Dec., 1958.

27. BURKE, E. N., and GOLDEN, J. L.: External Ventricular Laryngocele. *Amer. Jour. Roentgenol.*, 80:49-53, July, 1958.

28. SPECTOR, S., and BAUTISTA, A.: Foreign Body in the Larynx. *Arch. Otolaryngol.*, 67:458-459, April, 1958.

29. PALMER, H. D., and GUPTA, S. K.: Laryngeal Palsy Following Spontaneous Pneumothorax. *Brit. Jour. Tuberc.*, 52:328-329, Oct., 1958.

30. MARIN, A.: Contribution to the Surgical Management of Laryngeal Paralysis Following Thyroidectomy. *Rumanian Med. Rev.*, 2:84-86, Apr.-June, 1958.
31. CAPPS, F. C. W.: "Abductor Paralysis" in Theory and Practice Since Semon. *Jour. Laryngol. and Otol.*, 72:1-31, Jan., 1958.
32. CHIONG, A. T., and GORMAN, J. B.: Post-Thyroidectomy Paralysis of the Vocal Cords. *Philippine Jour. Surg.*, 13:384-386, July-Aug., 1958.
33. ARNOLD, G. E.: Vocal Rehabilitation of Paralytic Dysphonia. IV. Paralytic Dysphonia Due to Unilateral Recurrent Nerve Paralysis. *Arch. Otolaryngol.*, 68:284-300, Sept., 1958.
34. LEWY, R. B.: Room for Maneuver in Peroral Laryngoscopy; Presentation of a New Multipurpose Laryngoscope. *Arch. Otolaryngol.*, 68:501-502, Oct., 1958.
35. GROSS, P.: A Self-retaining Illuminated Laryngoscopic Speculum for Intratracheal Procedures. *Arch. Indust. Health*, 18:429-430, Nov., 1958.
36. BIZZARRI, D. V., and GIUFFRIDA, J. G.: Improved Laryngoscope Blade Designed for Ease of Manipulation, Reduction of Trauma. *Anes. and Analg.*, 37:231-232, Aug. 20, 1958.
37. MILES FOXEN, E. H.: A New Endolaryngeal Anaesthetic Tube for Laryngectomy. *Brit. Med. Jour.*, 1:1412, June 14, 1958.
38. YOUNG, T. M.: Anaesthesia for Laryngoscopy. *Anaesthesia*, 13:419-420, Oct., 1958.
39. WOLFSON, B.: Minor Laryngeal Sequelae of Endotracheal Intubation. *Brit. Jour. Anesth.*, 30:326-332, July, 1958.
40. BARTON, R. T.: Medicolegal Aspects of Intubation Granuloma. *Jour. A.M.A.*, 166:1821-1823, April 12, 1958.
41. BOYAN, C. P., and HOWLAND, W. S.: Management of Anesthesia for Laryngectomies. *Cancer*, 11:550-553, May-June, 1958.
42. BAILIE, R. W.; BOYLE, A. K., and MACIEJEWSKI, A.: Major Surgery of the Larynx Under Induced Hypothermia. *Jour. Laryngol. and Otol.*, 72:558-570, July, 1958.
43. HIRZEL, L. F.: The Superior Laryngeal Nerve in Relation to Thyroid Surgery. *West. Jour. Surg.*, 66:322, Nov.-Dec., 1958.
44. SCHOBINGER, R.: Spasm of the Cricopharyngeal Muscle as Cause of Dysphagia After Total Laryngectomy. *Arch. Otolaryngol.*, 67:271-275, March, 1958.
45. GRAHAM, J.; BARNES, N., and RUBENSTEIN, A. S.: Control of Bronchial Mucus in the Postoperative Period. *Jour. Internat. Coll. Surg.*, 29:485-495, April, 1958.
46. NORRIS, C. M.: Technique of Extended Frontolateral Partial Laryngectomy. *THE LARYNGOSCOPE*, 68:1240-1250, July, 1958.
47. COWAN, R. J., and MACDOUGALL, J. A.: Reconstruction of the Pharynx Following Laryngo-Pharyngo-Oesophagectomy. *Plast. and Reconst. Surg.*, 21:362-371, May, 1958.
48. STOLL, B.: Psychological Factors Determining the Success or Failure of the Rehabilitation Program of Laryngectomized Patients. *Ann. Otol., Rhinol. and Laryngol.*, 67:550-557, June, 1958.
49. PUTNEY, F. J.: Rehabilitation of the Postlaryngectomized Patient. *Ann. Otol., Rhinol. and Laryngol.*, 67:544-549, June, 1958.
50. NORRIS, C. M.: Rehabilitation of the Postlaryngectomized Patient.



I. Types of Clinical Cases and Their Resultant Esophageal, Pharyngeal, and Neck Deformities. *Ann. Otol., Rhinol. and Laryngol.*, 67:528-537, June, 1958.

51. MOSES, P. J.: Rehabilitation of the Postlaryngectomized Patient; the Vocal Therapist: Place and Contribution to the Rehabilitation Program. *Ann. Otol., Rhinol. and Laryngol.*, 67:538-543, June, 1958.

52. CONLEY, J. J.; DEAMESTI, F., and PIERCE, M. K.: A New Surgical Technique for the Vocal Rehabilitation of the Laryngectomized Patient. *Ann. Otol., Rhinol. and Laryngol.*, 67:655-664, Sept., 1958.

53. BAUTISTA, A. G.: Reconstruction Following Head and Neck Surgery and Vocal Rehabilitation of the Laryngectomized. *Philippine Jour. Surg.*, 13:387-393, July-Aug., 1958.

54. BARNEY, H. L.: A Discussion of Some Technical Aspects of Speech Aids for Postlaryngectomized Patients. *Ann. Otol., Rhinol. and Laryngol.*, 67:558-570, June, 1958.

55. STRUBEN, W. H., and GELDER, L. VAN: Movements of the Superior Structures in the Laryngectomized Patient. *Arch. Otolaryngol.*, 67:655-659, June, 1958.

56. PINSKER, O. T., and PROUD, G. O.: Studies on the Etiology of Papilloma of the Larynx. *Arch. Otolaryngol.*, 67:268-270, March, 1958.

57. WINSTON, P., and EPSTEIN, S. S.: Papilloma of the Larynx; a Clinico-pathological Study. *Jour. Laryngol. and Otol.*, 72:452-464, June, 1958.

58. HINTON, C. D., and WEINBERGER, M. A.: Granular-cell Myoblastoma of the Larynx. *Arch. Otolaryngol.*, 68:497-500, Oct., 1958.

59. CAMPBELL, J. S.; WIGLESWORTH, F. W.; LATARROCA, R., and WILDE, H.: Congenital Subglottic Hemangiomas of the Larynx and Trachea in Infants. *Pediatrics*, 22:727-737, Oct., 1958.

60. SOM, M. L.: Radiological Notes; Case No. 42. *Jour. Mount Sinai Hosp.*, 25:360-362, July-Aug., 1958.

61. HANDOUSA, and ELWI, A. M.: Some Clinicopathological Observations on Scleroma. *Jour. Laryngol. and Otol.*, 72:32-47, Jan., 1958.

62. WAGGONER, L. G.: Intralaryngeal Intratracheal Thyroid. *Ann. Otol., Rhinol. and Laryngol.*, 67:61-71, March, 1958.

63. PICKARD, B. H.: Leiomyoma of the Larynx. *Jour. Laryngol. and Otol.*, 72:950-955, Nov., 1958.

64. PIETRANTONI, L., and FIOR, R.: Clinical and Surgical Problems of Cancer of the Larynx and Hypopharynx. *Acta Otolaryngol., Suppl.* 142:1-61, 1958.

65. WORK, W. P.: Cancer of the Larynx and Pharynx; Diagnosis and Treatment. *THE LARYNGOSCOPE*, 68:1544-1549, Aug., 1958.

66. BARRETTO, P. DE M.: Nomenclature and Staging of Malignant Tumors of the Larynx and of the Hypopharynx. *Arch. Otolaryngol.*, 68:160-164, Aug., 1958.

67. HALL, I. S.: Sarcoma of the Larynx. *Jour. Laryngol. and Otol.*, 72:906-909, Nov., 1958.

68. SEYFRIED, L. A.: Selection of Therapy in Carcinoma of the Larynx. *Jour. Amer. Osteopath.*, 57:465-467, March, 1958.

69. SARMA, S. N.: A Study into the Incidence and Etiology of Cancer

of the Larynx and Adjacent Parts in Assam. *Indian Jour. Med. Res.*, 46:525-533, May, 1958.

70. PUTNEY, F. J.: Preventive Dissection of the Neck in Cancer of the Larynx. *Ann. Otol., Rhinol. and Laryngol.*, 67:136-144, March, 1958.

71. RUBENSTEIN, A. S.; GRAHAM, J., and BARNES, N.: Associated Carcinoma of Larynx and Lung. *Arch. Otolaryngol.*, 68:710-714, Dec., 1958.

72. OGURA, J. H.: Supraglottic Subtotal Laryngectomy and Radical Neck Dissection for Carcinoma of the Epiglottis. *THE LARYNGOSCOPE*, 68:983-1003, June, 1958.

73. MITCHELL, J. S., and HAYBITTLE, J. L.: A Study of Dose Levels in Radio-Iridium Gamma-ray Therapy. *Acta Radiol.*, 49:233-245, March, 1958.

74. MARCHETTA, F. C.; RIEGLER, H. C., and MAXWELL, W. T.: Carcinoma of the Extrinsic Larynx. *Surg., Gynec. and Obst.*, 107:429-432, Oct., 1958.

75. MULTANEN, I.: Histo-cytological Malignancy and Clinical Picture in Epidermoid Cancer of the Larynx. *Acta Otolaryngol.*, Suppl. 135:1-63, 1958.

76. JESBERG, N.: Carcinoma of the Larynx. *THE LARYNGOSCOPE*, 68:1251-1256, July, 1958.

77. HLADKY, R., and SPRINDRICH, J.: Cancer of the Larynx. *Neoplasma*, 5:171-179, 1958.

78. HAGAN, C. E., JR.: The Quandary of Laryngopharyngeal Cancer. *Northwest Med.*, 57:895-898, July, 1958.

79. FISHER, H. R., and MILLER, A. H.: Carcinoma *in situ* of the Larynx; a Ten Year Study of its Histopathological Classification, Prognosis and Treatment. *Ann. Otol., Rhinol. and Laryngol.*, 67:695-702, Sept., 1958.

---

#### AMERICAN ASSOCIATION FOR CLEFT PALATE REHABILITATION.

The American Association for Cleft Palate Rehabilitation will hold its Eighteenth Annual Convention at the Brown Palace Hotel, Denver, Colo., Thursday, Friday and Saturday, May 12, 13 and 14, 1960.

This Association is composed of medical, dental and paramedical specialists who are interested in the rehabilitation of persons with cleft lips and palates.

**CYLINDROMAS OF THE UPPER DIGESTIVE AND  
RESPIRATORY PASSAGES—A CORRELATIVE  
STUDY OF THEIR HISTOLOGIC PATTERNS,  
CLINICAL FINDINGS AND MODES  
OF THERAPY.\***

**BURTON J. SOBOROFF, M.D.,**

**Chicago, Ill.**

The cylindroma pattern of adenomatous tumors of the upper digestive and respiratory passages is a characteristic one that has been observed in tumors of the major salivary glands and those developing in the nose, paranasal sinuses, lips, mouth, pharynx, palate, tongue, larynx, trachea and bronchi. Numerous reports in the literature indicate that, although the cylindroma type of glandular tumor may occur in the major salivary glands, it is more common in aberrant or ectopic sites. Recent experience with three such tumors of almost identical microscopic appearance, in the nasal passages, tongue, and larynx respectively, make it seem of some value to report in more detail; further, their mode of spread is similar to that of a basal cell carcinoma with persistent tendency to recurrence in a slowly progressive destructive course. A review of the histologic and clinical characteristics of such tumors indicates the need for early, aggressive, adequate treatment.

In recent years, bronchial tumors, usually referred to as bronchial adenomas, have been diagnosed clinically with increasing frequency. In 1930, Kramer<sup>1</sup> reported on the findings and treatment of two such cases, and was able to find only five cases reported in the literature. Since that time many cases have been described. A study of the histologic picture of bronchial adenoma reveals that some of these tumors have the characteristic pattern of cylindroma and may have a very different and more serious clinical course than

\*Submitted as Candidate's Thesis to the American Laryngological, Rhinological and Otological Society, Inc., 1958.

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication Jan. 28, 1959.

that of the usual "adenoma." The histologic pattern and clinical course of these tumors have, therefore, been included in this study, because of their apparent relationship to other tumors arising in similar mucosa of the upper digestive and respiratory passages.

#### HISTORICAL REVIEW.

The cylindromas are a group of tumors now considered by most authorities to be of epithelial origin probably arising from the epithelium of the ducts or acini of mucus glands. They are undoubtedly malignant tumors and have been described by Harrison<sup>2</sup> as "a most formidably lethal group"; however, they were not always considered either malignant or of epithelial origin.

The cylindroma has received many different synonyms: adenoid cystic carcinoma (Spies<sup>31</sup>), basalioma (Krompecher<sup>4</sup>), adenocarcinoma of the mixed tumor type (New<sup>5</sup>), and by others it has been compared to skin tumors of the epithelioma adenoides cysticum variety. The bronchial adenoma, in a similar fashion, has been described by various names in many reports over the years.

Many of the tumors reported as adenoma from the bronchus have been cylindromas, and only in recent years has this been clearly recognized. Some considered bronchial adenomas to be of mesodermal origin, while others considered them to be of epithelial origin. A brief history of the various names given to these tumors will serve to indicate some of the confusion in regard to their origin and nature. At various times these bronchial growths were known as sarcoma of alveolar pattern (Ephraim,<sup>6</sup> 1911), cylindrical cell carcinoma (Kreglinger,<sup>7</sup> 1913), basal cell cancer (Geipel,<sup>8</sup> 1931), benign bronchial adenomata (Wessler,<sup>9</sup> 1932), carcinoids (Kernan,<sup>10</sup> 1935), adenocarcinomas (Moersch,<sup>11</sup> 1935), benign glandular tumors (Clerf and Crawford,<sup>12</sup> 1936), vascular adenoma (Zamora and Schuster,<sup>13</sup> 1937), endotheliomas (Welt and Weinstein,<sup>14</sup> 1937), and mixed tumors of the lung (Womack and Graham,<sup>15</sup> 1938).

The earliest report of salivary gland adenomas and cylindro-

mas was that of Billroth<sup>16</sup> in 1859. He reviewed the pathology and treatment of several cases of parotid tumors and originated the term "cylindroma" for one type of parotid tumor which to him appeared to consist of cylinders of mucoid stroma intertwined with the epithelial elements. He described in some detail one case of recurrent parotid tumor observed over a period of 23 years, requiring nine operative procedures. The tumor recurred and had all of the clinical characteristics of the cylindroma currently considered.

For many years after Billroth's communication, cylindromas were described with reports of other mixed tumors of the major salivary glands, especially those of the parotid. There was then much debate as to whether the cells in these tumors were of endothelial or epithelial origin. Both Billroth and Virchow considered them to be essentially of mesenchymal origin and that the most common type was a fibromyosarcomatous variety. They gave good descriptions of the mixed tumor but thought that they were of connective tissue origin. Others considered them to be of endothelial origin from the vascular tissue in the salivary glands. Ahlbom<sup>17</sup> has reviewed the early European literature and states that the endothelial hypothesis was reported by Kolaczek, 1878, Wartmann, 1880, and Volkmann, 1895. Still others thought that these tumors arose from mixed epithelial and mesenchymal structures and may have developed from an early, not yet differentiated embryonal anlage, the branchiogenic genesis first suggested by Cohnheim<sup>18</sup> in 1882.

Koestler<sup>19</sup> in 1867, used the term "cancroids" in describing glandular tumors which he felt were the same as Billroth's cylindroma, and Waldeyer,<sup>20</sup> 1872, described parotid tumors as a mixed group of tumors and compared them with mixed tumors in other organs. Minssen,<sup>21</sup> 1874, clearly applied the term "mixed tumors" in a review entitled "Mixed Tumors of the Parotid," and the term has been in general use since that time.

The first to express the opinion that mixed salivary gland tumors were epithelial in origin was Von Bruns, in 1859. Malassez,<sup>22</sup> 1883, in reviewing many reports was able to find 11 synonyms for what he considered were cylindromas and

supported the theory of their origin from epithelium. He added two cases of his own, one from the palate and the other from the submaxillary regions. Shortly afterward, Paget,<sup>23</sup> 1886, was one of the first to describe these adenomas in the palate and recognized that many of them resembled parotid mixed tumors. Hinsberg,<sup>24</sup> 1899, made a painstaking histologic study of nine mixed tumors and criticized the endothelial theory. He assumed that they started from embryonic rests of parotid anlage, and many observers afterward adopted his theory.

From this period at the turn of the Century onward, there was increasing support for the theory of the epithelial origin of salivary gland tumors, both in the major salivary glands and in ectopic sites, although considerable support still persisted for their connective tissue origin. Many tumors then called "sarcomas" would be classified otherwise at the present time. In a summary of the early literature Ringertz<sup>25</sup> indicates the high percentage of sarcomas when he reported:

Bosworth .....	1889	30 carcinomas	71 sarcomas
Finder .....	1896	47 carcinomas	100 sarcomas
Kummel .....	1900	40 carcinomas	69 sarcomas
Mejutin .....	1902	17 carcinomas	62 sarcomas

Ribbert,<sup>26</sup> 1907, strongly supported the epithelial theory. He reviewed the histology of cylindromas in much detail and gave a clearer definition of the term. His description indicates that the term cylindromas, or the cylindromatous tissue layers, involved both the epithelial structures and the mucoid supporting stroma.

Krompecher,<sup>4</sup> 1918, studied not only a large group of salivary gland tumors but also many tumors originating in the skin and described them with the term "Basallzellenkrebs," or basal cell cancer. He thought that both cylindromas and skin tumors were epithelial in origin, arising from the basal cell layer. He referred to many cylindromas as "basaliomas" and described both solid and cystic subgroups. Blumenfeld,<sup>27</sup> in 1914, described two tumors of the lip which appeared to be

of glandular origin, one of which had the typical appearance of a cylindroma.

Despite an increasing weight of evidence favoring epithelial origin, there were some who felt otherwise. Wilson and Willis,<sup>28</sup> 1912, carefully studied many parotid tumors and concluded that "there was little evidence that these tumors arise from proliferating adult epithelium or endothelium. There is considerable evidence to support the theory that these tumors are mesotheliomas of embryonic origin."

Fry,<sup>29</sup> 1927, reported in detail on the histologic structure of mixed tumors after a study of 25 cases and stated conclusively that they were epithelial in origin. He felt that both the mucin and the "cartilage" in these tumors were products of the glandular epithelial cells. He stated that the tumors showed varying degrees of malignancy with no definite dividing line between innocent and malignant; furthermore, Fry believed some of the more malignant formations may demonstrate many of the features typical of the innocent type of tumor.

Brunschwig,<sup>30</sup> 1930, described the prolonged course of two patients with cylindroma of the tongue and sublingual region. He found that neoplasms of this type closely resemble basal cell or adenocystic carcinoma. He presented photographs of microscopic sections showing the classic cylindroma pattern.

Spies,<sup>31</sup> 1930, reported on adenoid cystic carcinoma of cutaneous and non-cutaneous origin; the latter from the maxillary sinus, nasal mucosa and salivary glands. There were 21 cases of non-cutaneous origin, and his illustrations again reveal a typical cylindroma pattern. Three patients had widespread metastasis, one of skin origin, one from the nasal cavity, and one from the submaxillary gland. Both Brunschwig and Spies suggest a characteristic histologic and clinical picture of the cylindroma type of tumor.

New and Childrey,<sup>5</sup> 1931, reported on a large series of cases of adenocarcinoma of the mixed tumor type occurring in the tonsil and pharynx. Bredlau,<sup>32</sup> 1934, and Weidlein,<sup>33</sup> 1936, each reported a single case of a salivary gland tumor of the



nasal septum. Bredlau's patient evidenced the typical pattern of cylindroma.

Ahlbom,<sup>17</sup> 1935, reviewed 254 cases of mucous and salivary gland tumors. He considered the cylindromas to be of epithelial origin and accepted Krompecher's<sup>34</sup> classification, calling them basaliomas. Those tumors having the appearance of a cylindroma, he referred to as basalioma with cylindromatous features. Most of these tumors he considered semimalignant or frankly malignant.

Harvey, Dawson and Innes,<sup>35</sup> 1938, reported their histologic review of a large series of salivary gland tumors. They confirmed their epithelial origin but felt that the term cylindroma was a "misleading term for the actual microscopical appearances which are nevertheless characteristic." They felt it best to class them as adenomas but gave no follow-up record to indicate the clinical aspects of cylindromas.

Ringertz,<sup>25</sup> 1938, in an excellent review of the pathology of malignant tumors of the nose, paranasal sinuses and maxilla, reported 37 cases of mixed gland tumors. Like Ahlbom, he called those with a cylindromatous pattern, basaliomas. He found two varieties: the solid and the cystic. His illustrations, too, reveal the typical cylindroma pattern.

Kramer and Som,<sup>36</sup> 1939, reported six cases of cylindroma of the upper air passages. They described the clinical features of these tumors and considered them locally malignant with distant metastasis rare.

In 1942, Dockerty and Mayo<sup>37</sup> reported that 18.5 per cent of their series of 81 primary submaxillary gland tumors were adenocarcinoma of the cylindroma type. They found these tumors to have pronounced infiltrating qualities and a high rate of recurrence. Their illustrations demonstrate the typical cylindroma pattern.

Mulligan,<sup>38</sup> in 1943, reported that a survey of the literature indicated that metastasis of salivary gland tumors was uncommon as compared with recurrences. He reviewed 22 cases of such metastases. Sixteen of these were either diagnosed cylindroma or adenocarcinoma, with a similar histologic pic-

ture. His illustrations, like those of several preceding authors, demonstrate clearly adenocarcinoma and cylindroma.

Hellwig,<sup>38</sup> 1945, advanced the interesting theory that salivary gland tumors, particularly those of the parotid, submaxillary region and palate, developed from notochordal tissue adjacent to the foregut region. He felt that mixed tumors resembled the tissue of the adult nucleus pulposus.

Bauer and Fox,<sup>40</sup> 1945, reviewed the histology of six cylindromatous tumors of the palate, and concluded that the myoepithelial basket cells surrounding the acinar epithelium made up the new growths. They called the cylindromas adenomyoepitheliomas of the palatal mucous glands. Sheldon, in 1943, had described similar cells in certain types of mixed salivary gland tumors.

By this time there were sufficient reports from many clinics to indicate the similarity of many of these glandular tumors of epithelial origin having a cylindromatous pattern; further, the clinical significance of this histologic pattern became more impressive.

Quattlebaum, Dockerty and Mayo,<sup>41</sup> 1946, reported that 10 per cent of a series of consecutive primary parotid neoplasms appeared to be adenocarcinomas of the cylindroma type.

McDonald and Haven<sup>42</sup> reviewed 339 cases of malignant tumors of glandular nature in the nose, throat and mouth. Eighty-six of these were classified as cylindromas, and 15 of the 86 evidenced metastases. They stated that their study emphasized that one type of tumor, the cylindroma, "is a far more serious disease than generally recognized."

Pollock,<sup>43</sup> 1952, reported five cases of cylindroma of the nose and sinuses, considered them malignant tumors with a tendency to "relentless recurrence." Foote and Frazell,<sup>44</sup> 1953, studied over 500 tumors of the major salivary glands. Their illustrations clearly demonstrate many cylindromas which they classify as adenoid cystic carcinoma.

Russell,<sup>45</sup> 1955, reviewed a large series of adenomatous tumors of the anterior foregut region and suggested that the

name cylindroma be accepted for this type of tumor, which she again reported has such a grave prognosis.

Harrison,<sup>2</sup> 1957, reported on 63 cases of salivary adenomas of the buccal cavity, 36 of which showed the cylindroma pattern. These tumors also followed a slowly progressive course with many recurrences, repeated and persistent local infiltration, and late metastasis.

Adenomatous tumors of the trachea and bronchi have been reported for many years. As was previously stated, a review of the many names applied to these tumors indicates the confusion which has existed as to their origin and histologic pattern. Kramer,<sup>1</sup> 1930, reported two cases treated bronchoscopically and called them adenoma of the bronchus. Fried,<sup>46</sup> 1934, reported a case which he considered benign. His illustrations suggest cylindroma. It was about this time that adenomas of the bronchus became more widely recognized. Jackson and Konzelmann,<sup>47</sup> 1937, reported 12 cases, one of which is illustrated, and appears to be a cylindroma. Kramer and Som,<sup>36</sup> 1939, reported three bronchial cylindromas among six such tumors in the upper air passages and described the clinical features of these growths.

Brunn and Goldmann<sup>48</sup> reviewed 19 cases in 1941, crediting Wessler and Rabin, 1932, with giving a good earlier clinical description of the symptoms and findings of these tumors. By this time, however, they felt that surgery was the treatment of choice. Adams, Steiner and Bloch,<sup>49</sup> 1942, were among the first to recognize that there were two widely divergent schools of thought in regard to bronchial adenoma and its management. One group considered them benign, to be treated conservatively, while the other considered them as malignant, to be treated by wide surgical excision.

Clarf and Bucher,<sup>50</sup> 1942, reported 35 cases, some showing a cylindroma pattern. They did not, however, consider these bronchial tumors to be malignant and advised bronchoscopic removal unless they were not accessible. Laff and Neuburger,<sup>51</sup> 1944, reported two cases of bronchial adenoma with metastasis, and their illustrations definitely reveal cylindroma. Graham and Womack,<sup>52</sup> 1945, were aware of this

inconsistent behavior of these tumors when they titled their report "The Problem of the So-called Bronchial Adenoma."

Harrington, Moersch and McDonald,<sup>53</sup> 1946, in a "Symposium on Certain Tumors of the Bronchi," clearly divided these tumors into two groups, namely, adenomas and cylindromas, the latter containing some mucin secretion. Adenomas apparently were considered by some to be quite benign, had a uniform histologic picture and, in their opinion, a good prognosis. Belsey and Valentine,<sup>54</sup> 1951, reported three cases of cylindroma and felt that they behaved as carcinomas of low grade malignancy. Their photographs reveal a typical cylindroma with invasion of the perineural lymphatics. Reid,<sup>55</sup> 1952, attempted to clarify the situation when he reported that bronchial adenoma really includes two groups of tumors: 1. the more common, resembling carcinoid and having a benign course; 2. the other, which demonstrates the characteristic pattern identical with that of certain tumors of major and minor salivary glands. It is most commonly described as cylindroma, mixed tumor or adenoid cystic carcinoma. Among endoscopists and thoracic surgeons, there is now an awareness of the potentially malignant nature of certain bronchial tumors formerly considered benign. Van Hazel, Holinger and Jensik<sup>56</sup> have reported a series of these cases and specifically attempt to differentiate between adenoma and cylindroma because the clinical behavior of these two tumors can be so different.

#### REPORT OF CASES.

*Case 1.* Mrs. L. Y., a 67-year-old woman, was first examined on Nov. 12, 1956. Six weeks earlier, her son-in-law, a dentist, noted a small smooth swelling on the lateral margin of her tongue in the middle third, while extracting a tooth. On careful questioning there was no history of pain, tenderness, bleeding or any other symptoms. The past history revealed that she had been in good general health. She had pneumonia many years ago, however, without complications. She was on no medication and never smoked. There was no history of allergy or drug sensitivity.

On discovery of the tumor mass, excision biopsy was attempted by an oral surgeon who felt that it was not completely excised. The biopsy was reported as eyelindroma.

Physical examination was carried out about four weeks after the biopsy which revealed essentially normal findings in the ears, nose and throat. There was a small, slightly raised, non-tender, firm scar at the biopsy site in the lateral margin of the middle third of the left side of the tongue. The larynx and base of the tongue appeared clear, but there was much

lymphoid tissue at the tongue base bilaterally. No cervical nodes or masses were palpable. Chest and abdomen revealed no abnormal findings other than a well healed hysterectomy scar.

Laboratory examinations revealed the urine negative for sugar and albumin, with a S. G. of 1.020; w.b.c. 9600; hb., 85 per cent or 13.2 gms.; hematocrit, 43 per cent. Normal differential count. Wasserman: negative. Chest X-ray: normal findings. EKG showed a sinus rhythm with findings suggestive of mild coronary insufficiency.

There was no contraindication to surgery or general anesthesia, so on Dec. 6, 1956, under general anesthesia, the scarred area and residual tumor were palpably excised by a wedge excision. The postoperative course was uneventful, and there has been no evidence of recurrence to date.

Pathology report: moderately well differentiated adenocarcinoma (cylindromatous type).

*Case 2.* Mrs. M. O., a 39-year-old housewife, was first seen on Sept. 6, 1956. She had been treated two months earlier for severe nasal bleeding from the left side of her nose. When this was controlled, a smooth mass in that side of the nose was biopsied, revealing a malignant growth. The patient had a long history of "sinus congestion" on the left side over a period of many years. Colds always seemed to settle in the left cheek and beneath the left eye. There had been some nasal discharge of varying character, sometimes a sudden outpouring of watery material. Her general health had been good. She had a sensitivity to ragweed and had been given allergy "shots" regularly for seven or eight years.

Physical examination revealed a large, vascular, smooth mass filling the left side of the nose, apparently originating above the middle turbinate and extending down to the floor. The mouth and pharynx were normal. In the nasopharynx the left choana was blocked by the mass, but there was no extension of it to the vault or lateral wall. The ears and larynx were normal. Sinuses transilluminated fairly well. There were no nodes or masses in the neck.

Laboratory tests revealed a trace of albumin in the urine which was otherwise normal. Kahn: negative; w.b.c., 7050; hb., 85 per cent, 13.2 gms.; hematocrit, 43 per cent. Differential count was normal. Chest X-ray revealed no abnormal findings. Sinus X-rays showed a homogenous density in the left nasal cavity with some clouding of the left ethmoid cells. There was no evidence of any bone destruction.

On Sept. 18, 1956, the left nasal cavity was explored by way of a left lateral rhinotomy. The left maxillary sinus mucosa was normal, but there was inward bulging of the medial sinus wall. The tumor mass in the nose and the entire lateral nasal wall were resected with the turbinates.

Pathology report: well differentiated adenocarcinoma (cylindromatous type).

Study of the slides revealed perineural lymphatic invasion. Follow-up irradiation was considered advisable. This was given in the form of external irradiation to two ports. The total dose was 3000 r with the following factors: 200 KV; 20 MA; filtration: 1.2 mm. cu.; std: 50 cm.

*Case 3.* Mrs. A. W., a 60-year-old housewife, had had inspiratory dyspnea and a dry cough for about two years. Difficulty on inspiration became progressively worse, and was quite marked on exertion. She stated that she coughed up some dark material mixed with the mucus. She noted a progressive loss of weight from 225 lbs. to 190 lbs., over a period of two years.

Her general health otherwise had been good, with no serious illnesses over the years. Physical examination revealed an obese woman in no acute distress with slight respiratory stridor on deep inspiration. Ears, nose and throat appeared clear. There was moderate lymphoid hyperplasia at the base of the tongue.

Indirect laryngoscopy revealed normal vocal cords. Just below the right true cord was a large, smooth, pale tumor mass projecting into the subglottic airway and partially obstructing it. No nodes or masses were palpable in the neck. On November 1, 1956, direct laryngoscopy and biopsy were easily accomplished, and the patient returned to her room

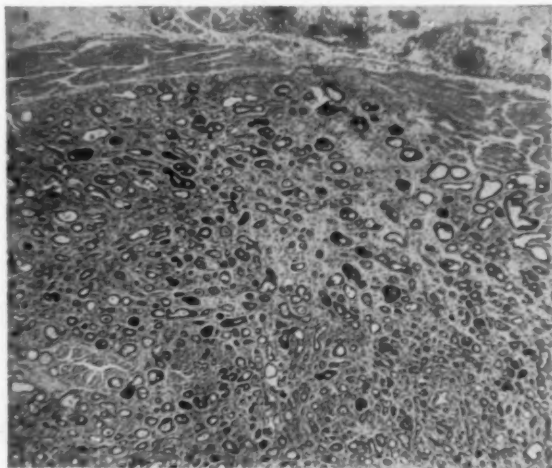


Fig. 1. Low power view of cylindroma of tongue showing typical pattern (X30).

breathing easily. Soon afterward, however, she developed more severe respiratory difficulty, and tracheotomy was done, giving immediate relief of all respiratory difficulty.

The pathology report of the large sessile subglottic mass was adenocarcinoma, cylindromatous type. On Nov. 12, 1956, total laryngectomy with wide resection of the tumor mass was done. About a year later she noted some difficulty swallowing. There was no evidence of tumor recurrence and complete relief was obtained by gentle dilatation with mercury filled bougies to 44 F. There has been no further difficulty in swallowing to date.

#### HISTOLOGY.

The histologic diagnosis of the cylindroma depends upon recognition of a rather characteristic tissue pattern which

has been reported throughout the literature. It differs from many other new growths in that it does not have any typical cells of distinctive shape, size and staining quality which are diagnostic. The pattern of the tumor (see Figs. 1 and 2) reveals a glandular structure which appears to arise from the ducts of mucous glands. The epithelium often shows a de-

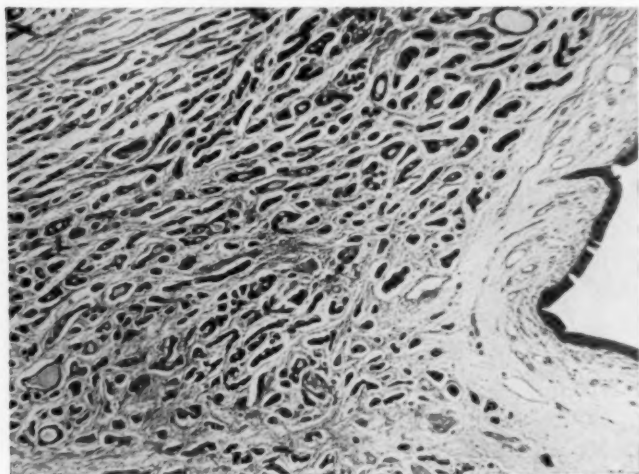


Fig. 2. Cylindroma of the larynx. Low power view of adenomatous pattern beneath intact mucosa (X330).

generative metaplasia of the cubical lining cells into small polygonal cells which have very little protoplasm.<sup>45</sup> It often evidences a rather strikingly uniform histologic appearance consisting of intertwining masses or cylinders of parenchymal cells surrounding rounded spaces filled by hyaline or mucoid eosinophilic or basophilic material. In many cylindromas there are gradations from the uniform and prominent fenestrated pattern (see Fig. 3) into more solid elements, or other patterns similar to basal cell epithelioma of the skin. This resemblance to certain basal cell skin tumors has been demonstrated by numerous investigators.<sup>31,57,58,59</sup>

Both Ahlbom<sup>17</sup> and Ringertz<sup>25</sup> employ the term basalioma



to describe these tumors. In their studies there is both a solid and a cystic variety of basalioma, each having the histologic characteristics of cylindroma, described many years earlier by Krompecher<sup>4</sup> under the name "basallzellenkrebs."

The cylindroma (basalioma of Ringertz; adenoid cystic carcinoma of Foote and Frazell<sup>44</sup>) appears to develop from the ducts of the mucous glands. This may be in the major salivary

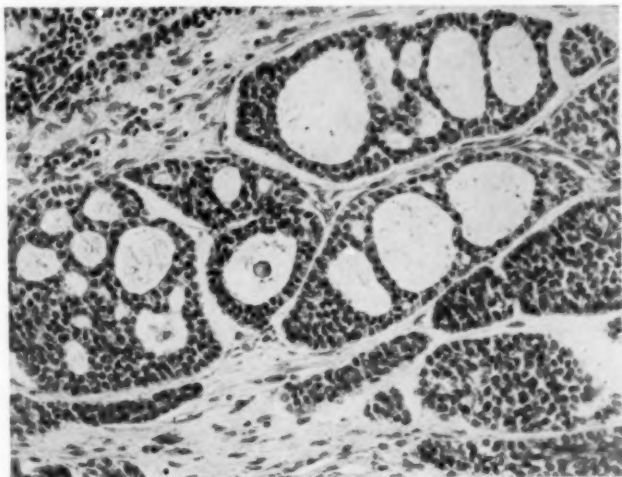


Fig. 3. Lacy pattern of adenocystic variety of cylindroma (nasal cavity) (X200).

glands (submaxillary and sublingual have mucous components) or in the mucous glands widely distributed beneath the mucosa of the upper digestive passages (palate, tongue, lips, mouth, pharynx) and the upper and lower respiratory passages.<sup>60</sup> These glands and ducts are clearly demonstrated beneath the mucosa of the tongue, palate, nose and larynx in Fig. 4. The large clear mucus-containing cells are surrounded by smaller more deeply staining cells. Bauer and Fox<sup>40</sup> studied several cylindromas and concluded that these smaller deeply staining cells gave rise to the tumor. These components are

called "basket cells" and are considered contractile elements, or myoepithelial cells. They described the masses of epithelial cells as basket cell masses and named the tumor "adenomyo-epithelioma." In many microscopic sections showing both normal glands and early tumor development, there appears to be more clearcut evidence of development of this tumor from the duct cells (see Figs. 5 and 6).

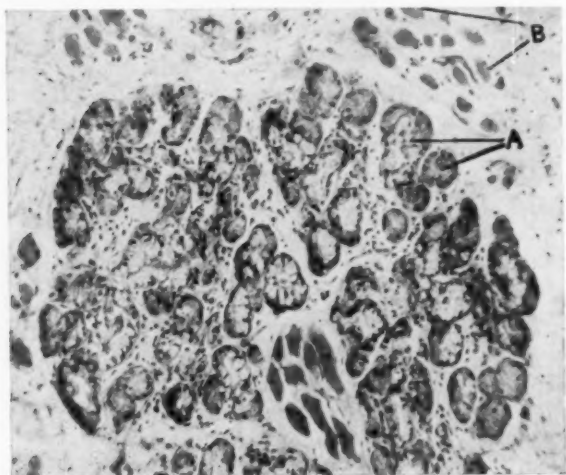


Fig. 4. Mucous glands and muscle in the submucosa of the tongue. A.—Normal acini; B.—Muscle fibers (X100).

Cylindromas may resemble mixed tumors, but usually they are found to be relatively circumscribed, about 2 to 4 cm. in diameter and reveal little tendency to encapsulation. The capsule, when present, is usually incomplete, probably accounting for the dangerous clinical character of the tumor, namely, its tendency to persistent infiltration. The mass is usually relatively firm, yellowish, or grayish white, having a homogeneous appearance with relatively little tendency toward cystic degeneration or hemorrhage.

Cylindromas of the trachea and bronchi usually possess a characteristic appearance. Inasmuch as they develop beneath

the mucosa, presenting themselves as a smooth rounded mass projecting into the lumen of the bronchus, they are often covered by intact bronchial epithelium. Their microscopic appearance is almost identical with that of cylindromas elsewhere. They may extend beyond the wall of the bronchus and are capable of infiltrating widely into the surrounding lung tissue.

The histologic pattern of Case 1 (tongue) is demonstrated

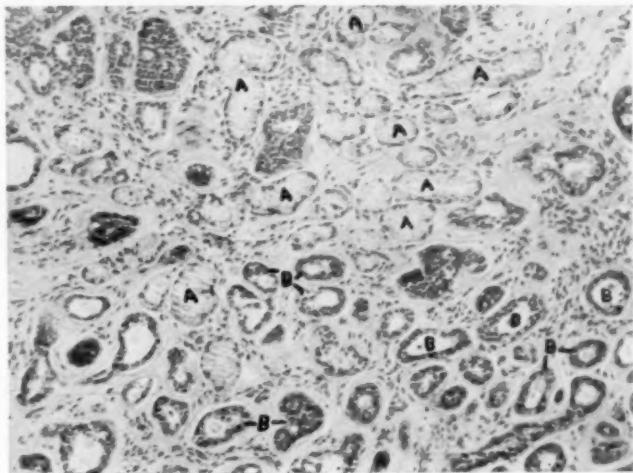


Fig. 5. Tumor of tongue with normal mucous acini (pale) surrounded by deep-staining tumor acini and ducts. A.—Normal acini; B.—Tumor.

in Figs. 1 and 6. There are numerous discrete duct-like tubules observed scattered through the partly destroyed and infiltrated tongue muscle. Some of the smaller masses appear quite solid. All are made up of small oval or cuboidal cells which stain deeply. The microscopic picture of Case 2 (nasal passage, middle turbinate region) is shown in Fig. 3. In this section there is more of the lacy, cystic pattern characteristic of an adenocystic carcinoma. Here again the epithelial masses consist of small, uniform deeply staining cells with large nuclei and a scanty cytoplasm. In some areas there are

large cell masses resembling basal cell carcinoma, sometimes described as a solid basalioma.

Case 3 (larynx) also demonstrates the characteristic pattern of cylindroma with many infiltrating adenomatous masses of deep staining cuboidal cells scattered through the stroma. Portions of this tumor, however, evidence many small solid masses of deep staining cells.

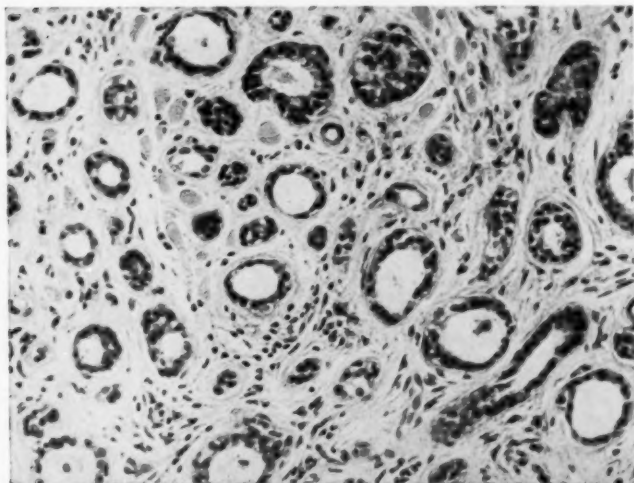


Fig. 6. Cylindroma in higher power view demonstrates the appearance of duct origin (X200).

The sections from three cylindromas, those of the tongue, nasal cavity and larynx, respectively, reveal a variety of patterns, all of which have an adenomatous appearance and consist of typical cell masses of deep staining cuboidal cells with large nuclei and scanty cytoplasm. Despite this variety of patterns, even within a single tumor mass, there is an overall uniformity of appearance readily recognizable as being characteristic of cylindroma. Numerous reports in the literature contain excellent illustrations which demonstrate this typical appearance.<sup>2,25,32,37,38,44,45,56,57</sup>

## CLINICAL ASPECTS OF CYLINDROMA.

Though the histologic picture of the cylindromas possesses a rather characteristic pattern, the clinical findings and course of these tumors do not. In a great measure these are dependent upon the site of origin of the tumor. It is generally agreed that these tumors originate from mucous glands which are scattered throughout the mucosa of the upper respiratory and digestive passages. The glands, with their ducts, may give rise to cylindromas beneath the mucosa of the lips,<sup>61</sup> oral cavity,<sup>42</sup> palate,<sup>2,65</sup> pharynx,<sup>5,36,43,62</sup> nose,<sup>25,32,33</sup> paranasal sinuses,<sup>17,23,36,43,63</sup> trachea,<sup>36,53,54,64</sup> or bronchi.<sup>36,49,51,54,55</sup>

These tumors may occur also in the large salivary glands. These glands have large, mucus producing acini (see Fig. 4) and many deep staining ducts lined with cuboidal epithelium. In the large salivary glands, benign, so-called mixed tumors, are common, especially in the parotid gland,<sup>66,67,68,69</sup> however, even in studies of large series of parotid gland tumors, a high percentage is found to be malignant, either adenocarcinoma or cylindroma. Quattlebaum, Dockerty and Mayo<sup>41</sup> found that 10 per cent of a series of consecutive primary parotid neoplasms appeared to be adenocarcinomas of the cylindroma type. This group of 21 patients had severe radiating pain and local fixation in over 40 per cent of cases, and facial nerve involvement was a commonplace experience. Surgically, the tumors were found to be more infiltrative than encapsulated. In this group there was an astounding recurrence rate of 75 per cent!

McDonald and Haven,<sup>42</sup> in a series of 339 cases, found 86 cylindromas. These produced symptoms referable to the site of origin and were characterized by slow growth, innocence of their gross appearance, and a marked tendency to recur following treatment. If cure is not accomplished, the tumor usually progresses slowly, attested to by the fact that 22 of the patients reported in this series lived an average of 7.4 years without cure.

The symptoms and findings reported by numerous authors are quite similar. Kramer and Som<sup>36</sup> found that the overlying mucosa was usually intact, although in some cases ulcera-

tion and breakdown has been reported, especially in lesions involving the oral cavity.<sup>2</sup> As was previously stated, the tumors are poorly encapsulated and tend to infiltrate surrounding tissues, losing mobility, and becoming fixed. They often are sessile masses with a wide base and a smoothly rounded surface.

Patients, in the series being reported here, demonstrated rather characteristic findings. The woman with a tumor of the tongue was not even aware of the presence of her tumor, which was found by her dentist during the course of a routine extraction. The mass itself was about 1.5 cm. in diameter covered by normal tongue epithelium with no bleeding or ulceration. Because of the paucity of symptoms produced in many instances, it is readily understood why these tumors can be present for a long period of time before they are noticed.

The second patient had a large intranasal cylindroma which produced the classical symptoms of carcinoma, unilateral obstruction and hemorrhage from the involved side of the nose. The mass itself was smooth, nonulcerated, filling the airway on the left side. It was readily recognized as a tumor on inspection of the nasal cavity and X-rays revealed no bone invasion or destruction. Sections of the tumor mass after surgical excision showed distinct perineural lymphatic invasion (see Fig. 7), considered to be one of the serious malignant features of this type of tumor.

The absence of a distinct capsule, the infiltrative tendencies and the invasion of adjacent perineural lymphatics lead to a high incidence of so-called recurrence of the disease, which may well be persistence of a slow growing tumor not completely eradicated.

Rawson, et al.,<sup>61</sup> in reviewing 160 cases of salivary gland tumors found 11 cylindromas. They grouped these with two other types of tumors as being of low-grade malignancy, malignant papillary cystadenoma and mucoepidermoid tumors. Despite this "low-grade" classification there was local recurrence in 91 per cent of the cylindromas.

Many other observers have reported a significant incidence

of carcinoma in salivary gland tumors, a high percentage of these being cylindromas. In one series<sup>72</sup> of 241 parotid tumors, 17.4 per cent were reported malignant. In another series<sup>27</sup> of 81 primary submaxillary gland tumors, adenocarcinoma of the cylindroma type was found in 18.5 per cent of the cases. These patients often had a brief clinical history with pain and local fixation as prominent features. There

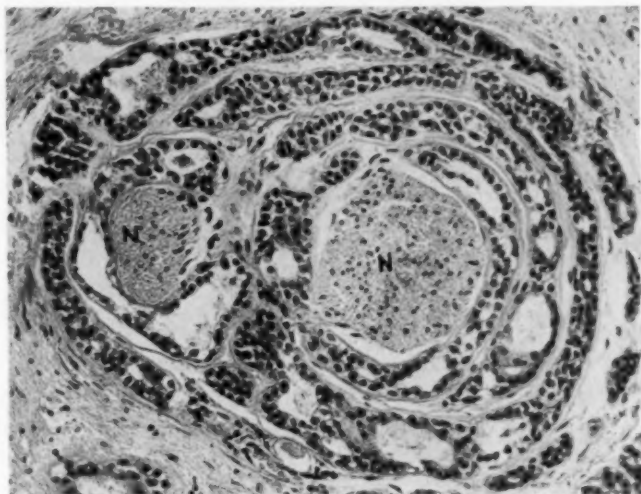


Fig. 7. Photomicrograph of cylindroma of nasal cavity showing perineural lymphatic invasion by masses of tumor cells. Deep-staining cells about the lighter nerve fiber (N) are the tumor cells.

were pronounced infiltration tendencies, with selective invasion of nerves. The rate of recurrence was high. Similarly, in another study of 212 cases of parotid tumors<sup>73</sup> the incidence of carcinoma was found to be at least 20 per cent.

Cylindromas occurring in the larynx, trachea and bronchi produce symptoms and findings characteristic of most tumors involving those anatomical sites. The third case reported in this series developed a tumor in the subglottic region beneath the right true vocal cord. Her symptoms were those which



developed as a result of the progressive enlargement of a mass encroaching on the airway. She noted increasing dyspnea with some stridor. Examination revealed a large, smooth sessile obstructing mass in the larynx, immediately beneath the right vocal cord. Biopsy revealed a cylindroma (see Figs. 8-a and 8-b). Tumors in the trachea such as these have symptoms in common. Bronchial tumors often bleed, and hemoptysis in young persons should give rise to suspicion of a bronchial tumor, possibly a cylindroma. Clerf and Bucher<sup>50</sup>

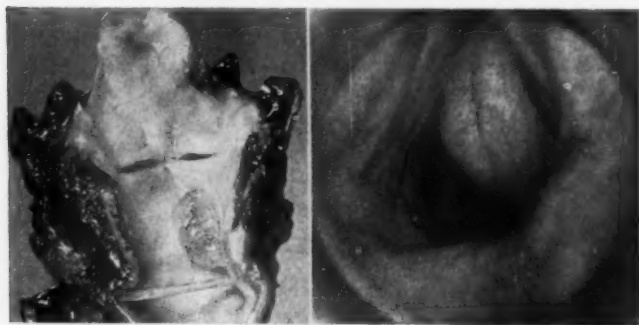


Fig. 8-a. Larynx, surgical specimen, opened posteriorly, revealing smooth tumor beneath the right true vocal cord. b.—Endoscopic view of cylindroma of the larynx.

reported three histologic types of bronchial adenoma, one resembling cylindroma; however, in their series, the clinical course of all three cases was found to be about the same. They did not consider it malignant and reported that these tumors did not metastasize, nor were they influenced by irradiation therapy.

Adams, Steiner and Bloch<sup>49</sup> took an entirely different point of view in their report of five cases. It was their opinion that it was impossible to determine if any polypoid bronchial tumor would remain continuously benign. They felt that the extent of these tumors could not accurately be determined by X-ray or by the bronchoscope, and that there was no way clinically to determine development of metastasis. Later,

others<sup>51,53</sup> reported bronchial adenoma with metastasis and the photomicrographic illustrations of these cases clearly reveal cylindroma. McDonald reviewed the histological findings in 27 cases of tracheal tumor, among them being eight cylindromas. The symptoms and findings included dyspnea, stridor, wheezing, atelectasis, emphysema, cough, and varying degrees of hemoptysis. X-ray studies often demonstrated a mass in the trachea with encroachment on the airway. Bronchoscopic examination revealed the site and extent of the tumor mass and permitted tissue to be removed for biopsy. In some patients treatment by bronchoscopic removal and fulguration was accomplished.

Reid<sup>55</sup> has urged that careful study of biopsy material should be carried out, because so-called bronchial adenomas reveal distinct histologic patterns, the one being cylindroma which, of course, has a much more serious prognostic significance. These should probably be treated surgically and considered as low grade malignant tumors.

We call attention to the fact that all three of the patients in the series being reported were women. Four were women in Pollock's series<sup>43</sup> of five cases. Others, likewise, have noted a preponderance of women having cylindromas. The majority of these tumors occur in adults, but one has been reported as having occurred in a child.<sup>74</sup>

#### METASTASIS.

There is sufficient clinical and histologic evidence to indicate that cylindromas should be considered as malignant tumors. Ahlbom<sup>17</sup> classifies some of them as "semimalignant" but it is difficult to understand exactly what that means. Since they are of glandular origin, the term adenocarcinoma, cylindroma type, would be more accurate, descriptive, and inclusive. Many of these tumors show a more anaplastic and less differentiated microscopic picture. It seems reasonable, however, that the term cylindroma should be retained because it connotes a certain rather specific, although unusual histologic pattern. There are a large number of reports in the literature describing metastasis from these tumors.<sup>2,17,25,30,31,37.</sup>

38,41,43,45,49,51,54,56 They can spread to the regional lymph nodes and later may evidence widespread general metastasis.

Harrison<sup>2</sup> has reported an illustration of extensive, bilateral pulmonary metastasis from a recurrent cylindroma of the palate. Russell<sup>45</sup> shows photomicrographs of two cases of distant metastasis; one from the oral cavity to the ilium, and the other from the tonsil region to the lungs. In each instance the metastases reveal the typical pattern of cylindroma.

The patients in this present series have thus far shown no evidence of metastatic spread after a period of observation of approximately two years. A careful follow-up is maintained, knowing that the prognosis must be guarded since these tumors often demonstrate a slow growth with late development of metastases.

Mulligan<sup>38</sup> reviewed 22 cases of metastases from "mixed" tumors of salivary glands. The most common sites of metastatic spread were the lungs, pleurae and liver. Less commonly involved were the bones, lymphatics, kidneys and spleen. In eight of these cases the term cylindroma was applied to the tumor. In eight others, adenocarcinoma, malignant glandular epithelioma, or cylindroma were considered. It would appear that 16 of the 22 tumors surveyed having metastases were either cylindromas or cylindroma-like adenocarcinoma of the salivary glands.

#### TREATMENT.

Over the years the treatment of salivary gland tumors has included incision and curettage, enucleation, surgical excision, irradiation, and combinations of pre- and postoperative irradiation with surgical excision. The most effective means of therapy for cylindroma in its variegated locations has not been clearly defined, although there is the current thought expressed that a combination of wide surgical excision and irradiation, before and after surgery, promises the best results.

A review of the past literature and a study of the histologic features of the three cases in the series being reported, clearly indicate that cylindromas are malignant tumors and should be treated as such. Some observers emphatically state that

the surgical<sup>73,76,77</sup> method is the treatment of choice, and that all accessible tumors should have as wide an excision as possible. They express the thought that radiation therapy alone has little value in the ultimate cure of this type of tumor, particularly when they occur in the parotid and submaxillary glands.

Spies,<sup>31</sup> in 1930, reported that cylindromas were radiosensitive, and employed irradiation therapy as the primary means of treatment. Since that time Ahlbom,<sup>17</sup> Ringertz,<sup>25</sup> and Edvall<sup>63</sup> have been the outstanding proponents of a combined radiosurgical approach to these tumors. The latter (Edvall) reports the routine use of telerradium preoperatively (1 to 3 fields, giving 2000 to 3000 *r* to each), followed by surgical excision after the skin reaction subsides. Following surgery, radium tubes were applied to the wound cavity for three to four hours. Although most of the tumors reported treated under this regimen were parotid tumors, there was an overall recurrence rate of only 3.6 per cent and the rate for the malignant tumors was only 12.8 per cent.

The patients in the series being reported were treated by wide surgical excision of the tumor. The nasal tumor was exposed by lateral rhinotomy, and the mass in the region of the middle turbinate was excised, together with the entire lateral nasal wall. No evidence of ethmoid or maxillary sinus involvement was observed. There was perineural invasion revealed histologically, so that this patient was given post-operative irradiation. The patient with the large subglottic tumor mass was treated by total laryngectomy. Since there was no evidence of spread beyond the larynx, no irradiation was given.

The treatment of cylindroma in the trachea or bronchi poses additional problems. Wide excision of tracheal tumors usually cannot adequately be carried out, so that bronchoscopic removal, followed by fulguration of the base is the treatment of choice. In the bronchi these tumors should probably be treated by surgical excision. The cylindroma of the bronchus has a more serious prognosis than the benign adenoma; therefore, wide excision is the treatment which will probably be most effective.<sup>48,49,54,55</sup> Local treatment through a broncho-

scope is usually less satisfactory since it often cannot clear up the distal lung suppuration nor remove tumor beyond the wall of the bronchus. Severe hemorrhage is another complication which demands an external surgical approach.

#### DISCUSSION.

The question of the histogenesis of salivary gland tumors of the cylindroma type has not been settled to the complete satisfaction of all investigators;<sup>80</sup> however, it can be stated that at the present time a sufficient body of evidence has been collected in the world literature to give much weight to the theory which favors the origin of such tumors from mucous glands and their ducts in the respiratory and upper digestive passages. It is possible that in the future, with the development of new techniques such as tissue culture or microstaining studies, additional information regarding histogenesis may be forthcoming.

In recent years, Hempleman and Womack<sup>78</sup> have conducted studies on mixed tumors to determine the origin of the myxomatous and cartilaginous areas by means of microchemical methods. These tests would indicate that the "cartilage" in these tumors is of mesenchymal origin, and the stromal changes in this epithelial tumor may be caused by so-called "organizer" substances in the tumorous epithelium.

Favata<sup>79</sup> compared tissue cultures of parotid tumors with cultures of duct cells from fetal parotid glands and found that both developed in essentially the same pattern. His study suggested that the pleomorphism that characterizes these tumors may result from secondary changes in a neoplasm composed almost exclusively of epithelium.

The cylindromas are a large and rather distinct group of new growths with a rather characteristic microscopic tissue pattern, recognizable in growths from areas as distinct anatomically as the nasal passages, tongue or bronchi. This characteristic pattern, probably best described as an adenocarcinoma, cylindroma type, has now been correlated in many reported cases with both the clinical findings and results of treatment.

The series reported here demonstrates the classic histologic pattern of cylindroma (see Figs. 1, 2, and 3). It indicates the varied sites at which such tumors may be found, and clearly evidences the origin of such tumors from the mucous glands. This series, though relatively small, reveals the characteristic development of this specific type of tumor. It has been found over the years that these poorly encapsulated tumors tend to grow slowly and progressively infiltrate the surrounding tissues. This occurs not only in the major salivary glands, but also in the buccal cavity, tongue, larynx or bronchi. They tend to recur after excision, and their rate of recurrence is exceedingly high, so that the prognosis must be guarded. They evidence a characteristic perineural lymphatic invasion. This series demonstrates the classic picture of perineural lymphatic invasion, one of the outstanding clinical features of this group of tumors.

Cylindromas of the upper digestive and respiratory passages are best treated by wide surgical excision. Many observers in recent years have recommended surgical excision combined with radiation therapy, to assure the best results, although some clinicians still consider that these tumors are radioresistant and advise radical surgical management. Many of these tumors occur in the parotid gland where the presence of the facial nerve in adjacent tissues makes surgery more difficult. Despite this, surgical treatment is the best means of managing these tumors. Janes<sup>78</sup> strongly supports this view in the management of parotid tumors and states, "No case in which an adequate removal seems possible, even though the whole facial nerve must be sacrificed, should be treated by radiation alone."

The recurrence rate of cylindromas is so high and the disease so relentless in its course that treatment must be instituted early and adequately if a cure is to be effected. Three cases of cylindroma have been reported in some detail in an attempt to increase the body of evidence which has been gathered in the literature about these tumors. These patients have all been treated with wide surgical excision. The tumor of the tongue showed no evidence of extension beyond that organ and was excised with a wide margin of normal tissue.

Such tumors in the buccal cavity are usually accessible to surgical treatment and can be excised. The tumor of the larynx was a large one immediately below the vocal cord. Wide excision of such a relentless growth was accomplished by total laryngectomy, encompassing the entire tumor and a margin about it.

These tumors occurring in the nasal cavity, paranasal sinuses or maxilla adjacent to the maxillary sinus should be treated by wide exposure through an external approach to the nose and resection of the tumor including the maxilla, if that, too, is involved. In this series the cylindroma was located high in the nasal cavity. Wide excision was accomplished through a Fergusson incision, combined with external irradiation therapy, because of the presence of perineural lymphatic invasion.

#### SUMMARY AND CONCLUSIONS.

Cylindromas appear to arise in mucous glands and their ducts and occur wherever these glands are found in the upper digestive and respiratory passages.

Their histologic pattern demonstrates some variability, but photomicrographs have been presented to demonstrate a rather typical pattern recognizable in tumors from many different anatomical sites.

These tumors, poorly encapsulated, infiltrate widely and have been shown to metastasize not only to regional nodes but also to distant sites.

Treatment must be instituted early and adequately. Wide surgical excision is the treatment of choice, although many feel that combined radiosurgical therapy is more effective. Surgically inaccessible tumors should be treated by irradiation.

The term cylindroma seems to be so descriptive of the typical pattern of the tumor that many have urged its general acceptance. Nevertheless, cylindromas are malignant tumors and the word "cylindroma" alone does not clearly reveal this. Since these tumors are of glandular origin, the term adenocarcinoma, cylindroma type, describes them more completely.



Three additional cases of adenocarcinoma, cylindroma type, are reported, including clinical findings, microscopic study and modes of therapy.

## BIBLIOGRAPHY.

1. KRAMER, R.: Adenoma of Bronchus. *Ann. Otol., Rhinol. and Laryngol.*, 39:689, 1930.
2. HARRISON, K.: Salivary Adenomas of the Buccal Cavity. *Ann. Otol., Rhinol. and Laryngol.*, 66:459, 1957.
3. ANDERSON, W. A. D.: "Pathology," 2nd Ed. C. V. Mosby Co., St. Louis, 1953.
4. KROMPECHER, E.: Der Basalzellenkrebs. *Arch. f. Laryngol. u. Rhinol.*, 31:443, 1918.
5. NEW, G. B., and CHILDEY, J. H.: Tumors of the Tonsil and Pharynx. *Arch. Otolaryngol.*, 14:699, 1931.
6. EPHRAIM, A.: *Med. Klin.*, 7:692, 1911.
7. KREGLINGER, G.: Ueber ein Primares Bronchial Karzinom. *Frankfurt Ztschr. f. Path.*, 12:135, 1913.
8. GEIPEL, P.: Concerning Our Knowledge of Benign Bronchial Tumors. *Frankfurt Ztschr. f. Path.*, 42:516, 1931.
9. WESSLER, H., and RABIN, C. B.: *Amer. Jour. Med. Sci.*, 183:164, 1932.
10. KERNAN, J. D.: Treatment of a Series of Cases of So-called Carcinoid Tumors of the Bronchus by Diathermy. *Ann. Otol., Rhinol. and Laryngol.*, 44:1167, 1935.
11. MOERSCH, H. J., and BOWING, H. H.: Primary Carcinoma of the Bronchus Treated Successfully by Diathermy. *Ann. Surg.*, 102:989, 1935.
12. CLERF, L., and CRAWFORD, B. L.: Benign Glandular Tumors of the Bronchus. *Tr. and Stud. Coll. Phys.*, Philadelphia, Fourth Series, 4:6, 1936.
13. ZAMORA, A. M., and SCHUSTER, N.: Vascular Adenoma of the Bronchus. *Jour. Laryngol. and Otol.*, 52:337, 1937.
14. WELT, B., and WEINSTEIN, S.: A Trio of Rare Bronchoscopic Cases. *THE LARYNGOSCOPE*, 47:30, 1937.
15. WOMACK, N. A., and GRAHAM, E.: Mixed Tumors of the Lung. *Arch. Path.*, 26:195, 1938.
16. BILLROTH, T.: *Virch. Arch. f. Path. Anat.*, 17:356, 1859.
17. AHLBOM, H. E.: Mucous and Salivary Gland Tumors. *Acta Radiol., Suppl.* 23, 1935.
18. COHNHEIM: "Vorlesungen uber Allgemeine Pathologie," 2nd Ed., Vol. I, Berlin, 1882.
19. KOESTLER, K.: *Virch. Arch. f. Path. Anat.*, 40:468, 1867.
20. WALDEYER, H. W. G.: *Virch. Arch. f. Path. Anat.*, 55:126, 1872.
21. MINSEN, H.: "Inang. Dissert." G. Hofer, Gottingen, 1874.
22. MALASSEZ, L.: Sur le Cylindre. *Arch. Phys. Norm. Path.*, 1:186, 1883.
23. PAGET, S.: *St. Bart's. Hosp. Med. Rep.*, 22:315, 1886.

24. HINSBERG, V.: *Deutsche Ztschv. f. Chir.*, 51:281, 1899.
25. RINGERTZ, N.: The Pathology of Malignant Tumors Arising in the Nasal and Paranasal Cavities and Maxilla. *Acta Otolaryngol.*, Suppl. 27, 1938.
26. RIBBERT, M. W. H.: *Dtsch. Med. Wschr.*, 33:126, 1907.
27. BLUMENFELD, F.: *Z. Laryngol. u. Rhinol.*, 6:779, 1914.
28. WILSON, L. B., and WILLIS, B. C.: The So-called "Mixed" Tumors of the Salivary Glands. *Amer. Jour. Med. Sci.*, 143:656, 1912.
29. FRY, R. M.: The Structure and Origin of the "Mixed" Tumors of the Salivary Glands. *Brit. Jour. Surg.*, 15:291, 1927-28.
30. BRUNSCHWIG, A.: Mixed Tumors of the Tongue and Sublingual Gland. *Surg., Gynec. and Obst.*, 50:407, 1930.
31. SPIES, J. W.: Adenoid Cystic Carcinoma. *Arch. Surg.*, 21:365, 1930.
32. BREDLAU, E. A.: Recurrent Basal Cell Carcinoma of the Nasal Septum. *Arch. Otolaryngol.*, 20:382, 1934.
33. WEIDLEIN, I. F.: Mixed Tumor of the Nasal Septum. *Ann. Otol., Rhinol. and Laryngol.*, 45:574, 1936.
34. KROMPECHER, E.: *Beitr. z. Path. Anat. u. z. Allg. Path.*, 44:51, 1908.
35. HARVEY, W. F.; DAWSON, E. K., and INNES, J. R. M.: Debatable Tumors in Human and Animal Pathology IV, "Mixed Tumors of Salivary Glands." *Edinburgh Med. Jour.*, 45:275, 1938.
36. KRAMER, R., and SOM, M. L.: Cylindroma of the Upper Air Passages. *Arch. Otolaryngol.*, 29:356, 1939.
37. DOCKERTY, M. B., and MAYO, C. W.: Cylindroma (Adenocarcinoma—Cylindromatous Type). *Surg.*, 13:416, 1943.
38. MULLIGAN, R. M.: Metastasis of Mixed Tumors of the Salivary Glands. *Arch. Path.*, 35:357, 1943.
39. HELLWIG: Mixed Tumors of the Salivary Glands. *Arch. Path.*, 40:1, 1945.
40. BAUER, W. H., and FOX, R. A.: Adenomyoepithelioma (Cylindroma) of Palatal Mucous Glands. *Arch. Path.*, 39:96, 1945.
41. QUATTLEBAUM, F. W.; DOCKERTY, M. B., and MAYO, C. W.: Adenocarcinoma, Cylindroma Type, of the Parotid Gland. *Surg., Gynec. and Obst.*, 82:342, 1946.
42. McDONALD, J. R., and HAVEN, F. Z.: A Study of Malignant Tumours of Glandular Nature Found in the Nose, Throat and Mouth. *Surg. Clin. N. Amer.*, 28:1087, 1948.
43. POLLOCK, R. S.: Cylindroma in Nose and Sinuses. *Arch. Otolaryngol.*, 55:210, 1952.
44. FOOTE, F. W., and FRAZELL, E. L.: Tumors of the Major Salivary Glands. *Cancer*, 6:1065, 1953.
45. RUSSELL, H.: Adenomatous Tumours of the Anterior Foregut Region Showing the Cylindroma Pattern. *Brit. Jour. Surg.*, 43:248, 1955-56.
46. FRIED, B. M.: Adenoma of Bronchial Mucous Glands. *Arch. Otolaryngol.*, 20:375, 1934.
47. JACKSON, C. L., and KONZELMANN, F. W.: *Jour. Thor. Surg.*, 6:312, 1937.

48. BRUNN, H., and GOLDMAN, A.: Bronchial Adenoma. *Amer. Jour. Surg.*, 54:179, 1941.
49. ADAMS, W. E.; STEINER, P. E., and BLOCH, R. G.: Malignant Adenoma of the Lung. *Surg.*, 11:503, 1942.
50. CLEEF, L. H., and BUCHER, C. J.: Adenoma (Mixed Tumor) of Bronchus. *Ann. Otol., Rhinol. and Laryngol.*, 51:836, 1942.
51. LAFF, H. I., and NEUBERGER, K. T.: Bronchial Adenoma with Metastasis. *Arch. Otolaryngol.*, 40:487, 1944.
52. GRAHAM, E. A., and WOMACK, N. A.: The Problem of the So-called Bronchial Adenoma. *Jour. Thor. Surg.*, 14:106, 1945.
53. HARRINGTON, S. W.; MOERSCH, H. J., and McDONALD, J. R.: Symposium on Certain Tumors of the Bronchi (Adenomas and Cylindromas). *Proc. Staff Mayo Clinic*, 21:409, 1946.
54. BELSEY, R. H. R., and VALENTINE, J. C.: Cylindromatous Mucous Gland Tumors of the Trachea and Bronchi. *Jour. Path. and Bact.*, 63:377, 1951.
55. REID, J. D.: Adenoid Cystic Carcinoma (Cylindroma) of the Bronchial Tree. *Cancer*, 5:685, 1952.
56. VAN HAZEL, W.; HOLINGER, P. H., and JENSIK, R. J.: Adenoma and Cylindroma of the Bronchus. *Dis. of Chest*, 16:146, 1949.
57. MOREHEAD, R. P.: Mixed Tumors of the Skin. *Arch. Path.*, 40:107, 1945.
58. DAVIES, J. H. T.: *Brit. Jour. Derm.*, 40:241, 1928.
59. STILLIANS, A. W.: Novo-Epithelioma Adenoides (Cylindroma) of the Scalp. *Arch. Derm. and Syph.*, 27:481, 1933.
60. MAXIMOW, A. A., and BLOOM, W.: "A Textbook of Histology," 4th Ed. W. B. Sanders Co., Philadelphia, 1942.
61. RAWSON, A. J.; HOWARD, J. M.; ROYSTER, H. P., and HORN, R. C. J.: Tumors of the Salivary Glands. *Cancer*, 3:445, 1950.
62. FOX, C. C.: Mixed Tumors of the Salivary Gland Type Seen in the Pharynx. *Arch. Otolaryngol.*, 30:73, 1939.
63. EDVALL, C. A.: Mucous and Salivary Gland Tumors—Treated Radio-surgically. *Acta Chir. Scandinav.*, 107:313, 1954.
64. BECK, J. C., and GUTTMAN, M. R.: Basaloma or So-called Cylindroma of the Air Passages. *Ann. Otol., Rhinol. and Laryngol.*, 45:618, 1936.
65. SMITH, A. G.; BROADBENT, T. R., and ZAVALA, A. A.: Tumors of Oral Mucous Glands. *Cancer*, 7:224, 1954.
66. McFARLAND, J.: Tumors of the Parotid Region. *Surg., Gynec. and Obst.*, 57:104, 1933.
67. *IBID.*: Histopathologic Prognosis of Salivary Gland Mixed Tumors. *Amer. Jour. Med. Sci.*, 203:502, 1942.
68. *IBID.*: The Mysterious Mixed Tumors of the Salivary Glands. *Surg., Gynec. and Obst.*, 76:23, 1943.
69. ROBBINS, G. F.: Tumors of Salivary Gland Origin. *Surg.*, 14:924, 1943.
70. KENNON, R.: Tumours of the Salivary Glands with Their After History. *Brit. Jour. Surg.*, 9:76, 1921-22.
71. TAYLOR, G. W., and GARCELON, G. G.: Tumors of Salivary Gland Origin. *New Eng. Jour. Med.*, 238:766.

72. STEIN, I., and GESCHICKTER, C. F.: Tumors of the Parotid Gland. *Arch. Surg.*, 28:492, 1934.
73. SLAUGHTER, D. P.; SOUTHWICK, H. W., and WALTER, L.: The Fate of Recurrent or Persistent Parotid Tumors. *Surg., Gynec. and Obst.*, 96:535, 1953.
74. HOWARD, J. M.; RAWSON, A. J.; KOOP, C. E.; HORN, R. C., and ROYSTER, H. P.: Parotid Tumors in Children. *Surg., Gynec. and Obst.*, 90:307, 1950.
75. JAMES, R. M.: Surgical Treatment of Tumors of the Salivary Glands. *Surg. Clin. N. Amer.*, 23:1429, 1943.
76. KEIM, W. F.: Management of Recurrent Mixed Tumors of the Major Salivary Glands. *Cancer*, 11:696, 1958.
77. BAILEY, H.: The Treatment of Tumors of the Parotid Gland. *Brit. Jour. Surg.*, 28:336, 1941.
78. HEMPLEMAN, L. H., and WOMACK, N. A.: The Pathogenesis of Mixed Tumors of the Salivary Gland Type. *Ann. Surg.*, 116:34, 1942.
79. FAVATA, B. V.: Characteristics of Mixed Tumors of the Parotid Gland Growing in Vitro. *Surg., Gynec. and Obst.*, 86:659, 1948.
80. HOUCK, J. W.: Tumors of the Salivary Glands. *Surg.*, 6:550, 1939.
81. BERDAL, P., and MYLIUS, E.: Cylindromas of the Respiratory Tract, the Upper Part of the Digestive Tract and Adjoining Organs. *Acta Otolaryngol., Suppl.*, 118:32, 1954.
82. SINGLETON, A. O.: Tumors of the Salivary Glands, Benign and Locally Malignant. *Surg., Gynec. and Obst.*, 74:569, 1942.
83. DOCKERTY, M. B., and MAYO, C. W.: Cylindroma (Adenocarcinoma, Cylindroma Type). *Surg.*, 13:416, 1943.
84. FRAZELL, E. L.: Clinical Aspects of Major Salivary Gland Tumors. *Cancer*, 7:637, 1954.
85. EWING, J.: "Neoplastic Diseases," 4th Ed. W. B. Saunders Co., Philadelphia, 1940.
86. JACKSON, C. L.; KONZELMANN, F. W., and NORRIS, C. M.: Bronchial Adenoma. *Jour. Thor. Surg.*, 14:98, 1945.
87. LE MAITRE, F.; ANDOLN, G., and LE MAITRE, Y.: *Acta Otolaryngol.*, 24:112, 1936.
88. MOERSCH, H. J.; TINNEY, W. S., and McDONALD, J. R.: *Surg., Gynec. and Obst.*, 81:551, 1945.
89. PAYNE, R. T.; TOD, M. C., and LEDERMAN, M.: The Diagnosis, Classification and Treatment of Tumors of the Salivary Glands. *Brit. Jour. Radiol.*, 17:3, 1944.
90. REISNER, D.: *Arch. Surg.*, 16:1201, 1928.
91. CLERF, L. H.: Adenoma of the Bronchus. *Ann. Otol., Rhinol. and Laryngol.*, 57:869, 1948.
92. GUTTMAN, M. R.: Primary Adenocystic Carcinoma or Cylindroma of the Trachea. *Ann. Otol., Rhinol. and Laryngol.*, 45:894, 1936.
93. DOTY, R. D.: Bronchial Adenoma. *Jour. Thor. Surg.*, 21:349, 1951.

## AN UNUSUAL CASE OF ETHMOIDAL MUCOCELE.

Surgical Management and Ten-Year Follow-up.\*

D. A. CORGILL, M.D.;  
BRUCE F. HOLDING, JR., M.D.,  
and  
ROBERT G. TROMLY, M.D.,  
Dallas, Tex.

The case presented here is significant because of its etiology, clinical course, surgical correction, and especially because of its extended and closely evaluated postoperative period.

A mucocele is basically a retention of mucoid secretions within a paranasal sinus that may result in erosion of its bony confines. There is some disagreement as to exactly what structural components are necessary for a diagnosis of mucocele. The following classification has been offered:<sup>1</sup>

1. *Primary Mucocele.* This type is considered to be a "true mucocele" and consists basically of a thin-walled sacular swelling. The membranous capsule consists chiefly of goblet cells. Its retained mucinous secretions are thin and lemon yellow in color. There is a notable lack of inflammatory responses. Such a cystic structure may have erosive potential and probably has its origin from an occluded goblet cell.

2. *Secondary Mucocele.* This type is characterized by a relatively thick wall of sinus mucosa. There is preservation of the lining epithelium, but no particular predominance of glandular elements. Evidence of chronic inflammation is usually present. The contained fluid, probably an exudate, may vary widely in character from serous to a thick greenish sludge with cholesterol crystals. When purulent exudate predominates, the structure is often referred to as a pyocele. Such secondary mucoceles are more frequently encountered than the "true" type and probably have their inception in

\*From the Department of Otolaryngology, Veterans Administration Hospital and the University of Texas, Southwestern Medical School, Dallas, Tex.  
Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication July 15, 1959.

the complete occlusion of the natural drainage system of the sinus involved.

Mucoceles are not rare but can be considered uncommon. The age incidence varies widely, but the average is around 40 years. The sex appears to bear little relationship. The frontal sinus is the most usual site with the ethmoid labyrinth next in frequency. The sphenoid and maxillary sinuses are rarely affected.<sup>2</sup>

The pathophysiological mechanisms necessary for the development of a mucocele are disputed, but most authors agree that inflammation and occlusion of drainage are prime factors.<sup>3,4,5,6,7</sup>

Occlusion and infection may occur during the course of a variety of common problems, such as a severely deviated nasal septum, nasosinal allergy, nasal polyposis, or possibly benign tumefactions. Trauma to the face and head with resulting fracture of the sinuses may be the antecedent cause. Previous surgery to the frontal and ethmoid sinuses may at times be a factor. Weille, in a review of 276 external frontal sinus operations, found a total of 16 postoperative mucoceles. Thirteen of these followed a Jansen-Lynch or Killian type procedure, while only three were subsequent to obliteration of the sinuses.<sup>8</sup>

The danger in a mucocele lies in its rather marked tendency for slow incipient expansion into neighboring cavities of the skull. The signs and symptoms produced by such a growth are related to its expansion into or pressure upon adjacent structures. It may erode into another sinus cavity, into the nasal cavity, into the cranial cavity, or into the orbit. Because of the relative frequency of frontal sinus mucocele, and with its predilection for involving the orbit, the ophthalmologist is often the first physician to encounter the patient with such a growth.

The diagnosis is suspected when any cystic type mass involving a paranasal sinus can be demonstrated. A roentgenographic examination of the area involved is usually highly informative. The involved sinus characteristically appears expanded with a decrease in its density. The usual muco-

periosteal line becomes indistinct while the sinus wall assumes a smooth outline with a loss of septa and scalloping. Bony erosion of a sinus wall may at times be apparent. On occasions the erosion may be so marked that a true malignant tumor may be suspected from the roentgenogram.<sup>9</sup>

#### CASE REPORT.

*Present History:* The patient, a 30-year-old white male, was admitted to the E.N.T. service on Feb. 11, 1949, complaining of continuous headaches for the past three weeks. The headaches were described as severe and incapacitating. The "bursting" type pain was localized over the central portion of the forehead. The patient states that at the age of eight years he was kicked in the face by a horse, which resulted in a gross nasal and facial deformity. He describes periodic headaches in his childhood, and a partial loss of vision in the left eye since the accident. At times he has a clear, watery-to-thick mucoid nasal discharge that seems to bear no relationship to his headaches. Since 1943 his headaches have become much more severe, and for the past few years he has been taking as many as 20 aspirin tablets a day for relief. He states that because of his continued pain he has become very irritable and cannot concentrate on any type of work. He has not held regular employment since his army discharge, but has worked as a day laborer at odd intervals. He alleges to have frequent clashes with his wife and children due to sudden emotional outbursts and inability to control his feelings. Approximately two years ago he began to drink alcohol to excess in order to relieve his pain and nervousness.

*Past History:* The following portion of the past history was verified by official military sources and from the records of previous hospitalizations. The patient served in the armed forces from Nov. 30, 1942, until June 19, 1943. During this period he was seen in the dispensary on numerous occasions because of headache. He was eventually hospitalized and given a neuropsychiatric discharge. Following his discharge from the service he was not hospitalized again until February, 1948, at which time he was treated for pneumococcal meningitis. He apparently recovered completely after antibiotic therapy and was released. His next hospitalization was not until Nov. 12, 1948, at which time he was admitted to a neuro-psychiatric service for evaluation for insulin shock therapy; however, while in the hospital he developed a thick mucoid nasal discharge, nuchal rigidity, and fever. No organisms were cultured from the spinal fluid, but the cell count revealed an increase in polymorphonuclear leukocytes. The hospital record stated that no evidence of cerebro spinal fluid rhinorrhea was found. He was again treated with antibiotics and released.

*Physical Examination:* Examination at the time of this admission to otolaryngology revealed a well developed, well nourished individual in no acute distress, but complaining of localized frontal headaches (see Fig. 1). Temperature 98.6°, blood pressure 140/75, pulse 80 and regular. E.N.T. examination revealed the nose grossly deformed by a saddle-type deformity with a scarred and distorted nasal lobule. There was crusted exudate in both nares. The mucosa of the posterior nasopharynx was moderately hyperemic as visualized by nasopharyngoscopy. Complete anosmia was noted. A gross hemianopsia was present in the nasal field of the left eye. The remainder of the examination was noncontributory.

Ophthalmological consultation confirmed the hemianopsia, which was



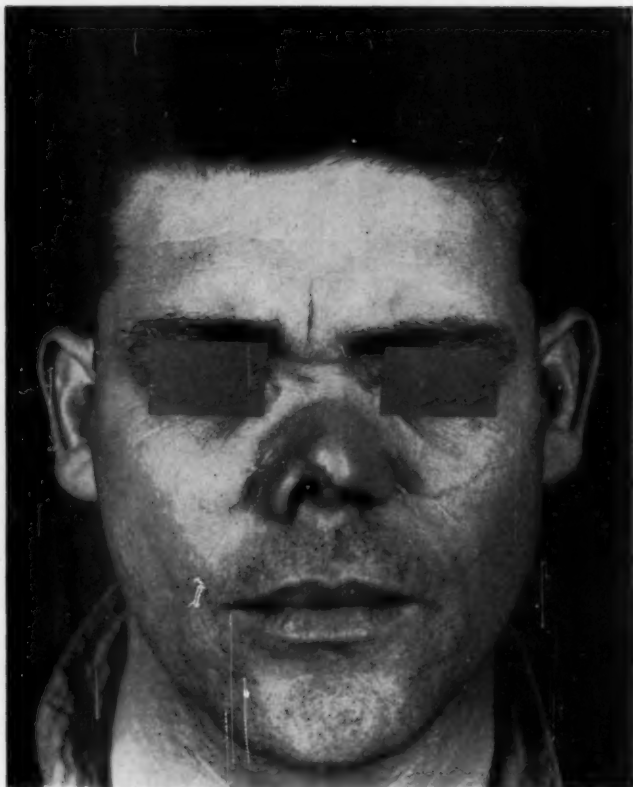


Fig. 1. Preoperative Photograph.

secondary to optic atrophy and probably resulted from a fracture through the optic foramen sustained at the time of his childhood injury.

*Laboratory and X-ray:* Laboratory data, including spinal fluid examination were within normal limits. A chest X-ray revealed no evidence of pathology. Sinus X-rays revealed clouding and thickening of the mucoperiosteal lining of the left maxillary sinus; the right maxillary sinus was clear. The frontal sinuses were small and shallow. The sphenoid sinuses were clear. There was a large cystic area in the midline between the orbits in the region of the ethmoid sinuses (see Fig. 2). Special views of the floor of the anterior cranial fossa demonstrated an absence of bone in the cribriform plate.

*Course in the Hospital:* After the work-up was completed it was felt



Fig. 2. Preoperative Water's view of paranasal sinuses showing large cystic appearing area in the region of the ethmoid sinuses.

that the patient had a large mucocyst in the region of the ethmoid sinuses. The following operation was performed on Feb. 10, 1949.

Under general endotracheal anesthesia an eyebrow incision for exposure of the frontal and ethmoid sinuses was made on the right. After the soft tissue and periosteum were elevated near the medial canthus, a thick wall cyst, dark green in color was encountered. There was marked erosion of the orbital wall of the anterior ethmoid cells and of the nasal bones. The latter terminating inferiorly in a feathered edge at their midportion. A similar incision was then made on the left side and joined across the root of the nose. The nasal bone and orbital wall of the anterior ethmoids were similarly involved on this side. The cyst



Fig. 3. Photograph of patient ten years postoperatively.

had completely replaced the entire ethmoid labyrinth bilaterally, and in addition had eroded into the lower third of the frontal sinuses, bilaterally destroying the floors and any recognizable ducts. The frontal sinuses were filled with thick, dark green secretions while the mucosa was indurated and polypoid in nature. After the sac was dissected laterally and posteriorly, it was necessary to open it to facilitate removal. The sac contents consisted of a dark greenish viscous fluid, in which numerous

cholesterin crystals were noted. After the sac was dissected inferiorly, the remaining cavity communicated through a wide aperture with each side of the nasal vault. Superiorly, the dehiscence in the floor of the anterior cranial fossa could be palpated in the midline and measured approximately  $1\frac{1}{2} \times 3$  cm. No cribriform plate could be identified. All of the cyst was then removed except for its superior aspect, where it was left *in situ* as a covering for the dura mater in the floor of the anterior cranial fossa. Next, a bilateral radical obliterative frontal sinus pro-

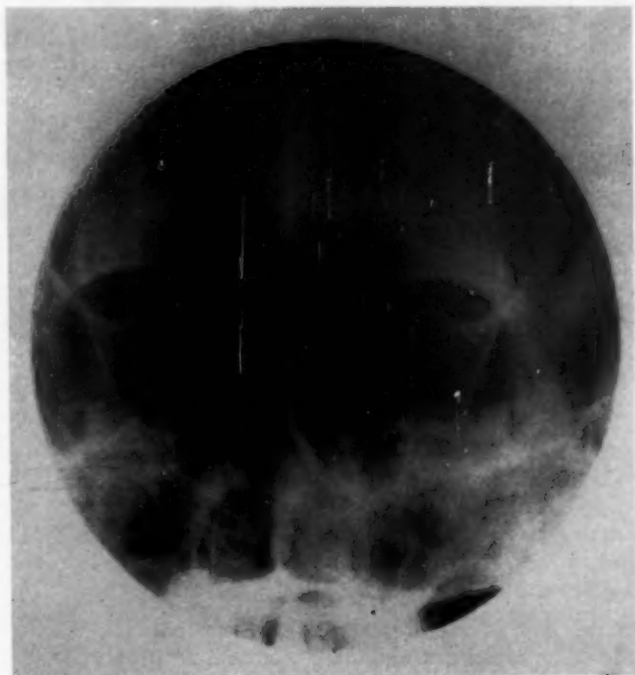


Fig. 4. X-ray of paranasal sinuses ten years postoperatively, showing residual defect in ethmoid area.

cedure was performed. Several layers of gelatin foam were placed over the defect in the floor of the skull. Iodoform gauze was then utilized as intranasal packing. The incision was closed and a pressure dressing applied. There was a brisk hemorrhage during the procedure, and the patient received 1,000 cc. of blood while on the table. There were no surgical complications.

*Immediate Postoperative Period:* The patient maintained a temperature of  $100^{\circ}$  to  $101^{\circ}$  for the first three days postoperatively, and then

became afebrile and remained so. The sutures were removed on the fifth postoperative day. The nasal packing was gradually removed and was completely out by the tenth postoperative day. The patient was maintained on antibiotics for three weeks. The pathologic report on the surgical specimen was compatible with a mucocele (secondary type). Examination by the third week postoperatively revealed a slight flattening of the forehead. The external wound was completely healed. Nasopharyngoscopy showed the area previously occupied by the mucocele to be apparent now as a concavity. The roof of the nasal vault appeared to be partially lined by granulation tissue and partially by ingrowing mucosa. The patient's headaches gradually subsided and he was discharged one month after surgery.

*Follow-up Course:* This patient has been followed at intervals for a period of ten years. The last examination prior to this report was February, 1959. At this time the patient presented a pleasant, pleasing, co-operative personality. He is free from headache, except for an occasional "tension headache" in the back of his neck which he experiences after an unduly trying day working in his drugstore, which he owns. He is free of nasal discharge or discomfort except when he has an upper respiratory infection which he experiences infrequently. His anosmia has persisted. He has had no more symptoms of meningitis or sinusitis. His alcohol consumption is no longer a problem, and he states that he and his family now enjoy a wholesome relationship. Examination on the last visit revealed the previously described nasal deformity and minimal forehead deformity. The mucous membranes of the nose appeared healthy. Nasopharyngoscopy revealed a definite concavity occupying the region of the cribriform plate. This area appeared to be lined by normal healthy mucous secreting membranes, and no granulation tissue was in evidence. Transmitted pulsation of the overlying cerebral cortex was noted (see Figs. 3, 4).

#### COMMENTS AND CONCLUSIONS.

The antecedent cause of this patient's mucocele would seem to be his facial trauma in early life. Although his complaints of headaches had apparently existed from that time, it was some 23 years later before the cause of such headaches was determined.

In this age of rapidly increasing facial trauma, fractures of the sinus cavities are naturally increasing proportionately. The primary emphasis in the management of sinus trauma is the prevention of infection and its sequela; and the restoration of function and cosmesis. It would also appear advisable to give more consideration to the probable but often long delayed pathology which may result from such trauma. As experience mounts and long term observations increase, it may indicate that more vigorous initial therapy will be necessary in such injuries. This is especially true if there is a history of previous sinus infection or upper respiratory allergy.

This patient also had at least two episodes (and probably more) of bacterial meningitis, probably resulting from the destruction of the usual naso-cranial barriers. The association of intracranial infection and recent previous or co-existent head trauma is not infrequent; however, the coincidence of acute meningitis with chronic disease elsewhere in the skull is generally neglected. Such correlation, however, is a fundamental precept in the management of chronic suppurative states about the cranial cavity, the time honored province of the otolaryngologist. It should be our responsibility to disseminate such a concept more widely.

This individual's personality stamp of psychoneurosis seems to have played a substantial influence in his delayed diagnosis. Any patient who bears such a stigma should be critically examined. Functional disorders are so frequent in all aspects of modern medicine that one may become exceedingly complacent about making such a diagnosis. It would appear that symptoms involving the head and neck structures are more readily ascribed to a functional basis than are complaints pertaining to other areas of the body where physical examination is less demanding.

The surgical correction of a mucocoele involving the fronto-ethmoidal area is at times difficult. In this instance no attempt was made to remove the mucocoele *in toto*. The superior wall of mucocoele was left intact as a covering for exposed dura of the anterior fossa. To dissect this portion of the wall from the dura might have resulted in a dural tear, cerebrospinal fluid rhinorrhea or possibly postoperative intracranial infection. If the sac had been removed in this area it may also have required the application of some substance such as fascia or skin graft, as covering for the dura. By leaving the sac lining composed of sinus mucosa, functioning mucous membrane apparently has resulted. Marsupialization of the sac seems to have allowed recovery of the mucosa to a functional state, and at the same instance provided an adequate covering of the bony dehiscence.

In the case presented here the mucocoele had eroded into three adjoining cavities: the nasal, the cranial, and the frontal sinuses; the latter being extensively diseased. Be-

cause of these operative findings, the incapacitating symptoms and the protracted clinical course, the obliterative type of frontal procedure was clearly mandatory. The postoperative deformity was minimal, and the patient did not desire plastic correction of his brow or of his pre-existing nasal deformity.

## REFERENCES.

1. COATES, G. M.; SCHENCK, H. P.; and MILLER, M. V.: *Otolaryngology*, Vol. III, Chap. 9. W. F. Prior Co., Inc., Hagerstown, Md., 1955.
2. NEFFSON, A. H.: Mucocoele of the Sphenoid Sinus. *Arch. Otolaryngol.*, 66:157-164, Aug., 1957.
3. THOMSON, ST. C., and NEGUS, V. E.: "Diseases of the Nose and Throat," Ed. 4. Appleton-Century-Crofts, Inc., New York, 1937.
4. TAMARI, M. J., and O'NEIL, J. J.: Mucocoeles. *Jour. Laryngol. and Otol.*, 63:24-30, Jan., 1949.
5. MORMAN, W. D.: Mucocoele of the Fronto-Ethmoid Area. *Ann. Otol., Rhinol. and Laryngol.*, 56:927-931, Dec., 1947.
6. SKILLERN, R. H.: "The Accessory Sinuses of the Nose," 4th Ed. J. P. Lippincott Co., Philadelphia, 1923.
7. KAPLAN, S.; SCHWARTZ, A., and METSON, B. F.: Mucocoele of the Frontal and Ethmoid Sinuses. *Arch. Otolaryngol.*, 51:172-187, Feb., 1950.
8. WEILLE, F. L.: External Sinus Surgery. *Surg., Gynec. and Obst.*, 84:853-858, April 15, 1947.
9. ANTHONY, W. P., and WILLIAMS, H. L.: Unilateral Pansinal Mucocoele Simulating a Malignant Neoplasm. *Arch. Otolaryngol.*, 53:189-194, Feb., 1951.

723 Town Creek Drive.

---

THIRTY-THIRD ANNUAL SPRING CONGRESS OF GILL  
MEMORIAL EYE, EAR AND THROAT HOSPITAL.

The Gill Memorial Eye, Ear and Throat Hospital announces to the profession its Thirty-third Annual Spring Congress in Ophthalmology and Otolaryngology, April 4 through April 9, 1960. A formidable list of speakers will participate.

For further information write: Superintendent, P. O. Box 1789, Roanoke, Va.



**TREATMENT OF LARYNGEAL PAPILLOMATOSIS  
WITH BOVINE WART VACCINE: REPORT  
OF CASES.\***

**O. P. MOFFITT, JR., M.D.,  
Wichita Falls, Tex.**

Wart vaccine of bovine origin is commonly employed in veterinary medicine for treatment of papillomata of the oropharyngeal membranes of domestic animals and pets. This has been prepared by extraction and formalin treatment of warty masses from healthy young calves.<sup>1</sup> More recently, a bovine vaccine of embryonated chick embryo origin is available. Rather uniformly good results are anticipated, particularly in the treatment of cattle and dogs. Occasionally, autogenous vaccines have been effective after failure of commercially prepared vaccines.

A young female child with rapidly growing papillomata presented a dangerous clinical course in spite of tracheotomy and repeated avulsions of the diseased tissue. The effect of bovine vaccine was tested. A rather dramatic cessation of regrowth occurred. This, and three subsequent cases in which the use of vaccine may have had some influence on the course of the disease, are presented.

Prior to its use, the bovine wart vaccine was further processed by passing it through suitable filters and culturing for contamination. A course of injections was then given to a volunteer, who represented an adult recurrence of laryngeal papillomata.†

**REPORT OF CASES.**

*Case 1.* S.N. was first seen in July, 1955, at the age of two years. She had been treated for hoarseness of six to eight weeks' duration, with various antibiotics. A direct laryngoscopy at this time revealed a rounded

\*From the Department of Otolaryngology, Wichita Falls Clinic-Hospital.  
†Carl Prichard, Wichita Falls, Tex., prepared this vaccine from veterinary stock and took a series of injections. No beneficial results were apparent, nor was there any indication of ill-reaction in his case.

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication April 26, 1959.

nodular mass which was removed from the area of the anterior commissure. The pathologic diagnosis was papillomata. On her release from the hospital, she was placed on a course of tetracycline drugs, which were continued through the next six weeks.

During the remainder of 1955, she was hospitalized on three different occasions for gradually increasing hoarseness and wheezing respiration on exertion. In each case, papillomatous masses were avulsed from the larynx. Tetracyclines were given for four to six weeks, and on two occasions podophyllum was applied locally to the larynx.

In January, 1956, she developed an episode of tonsillitis and fever, with increasing respiratory obstruction which required a tracheotomy. Subsequent direct laryngoscopy showed a marked extension of papillomatous material, with obstruction of at least two-thirds of the glottic lumen; this was avulsed. An applicator of cotton soaked in radioactive phosphorus for the purpose of providing localized Beta radiation was prepared. A surface dose of irradiation was given following avulsion of the papillomata.\* She was released from the hospital with the tracheotomy tube still in place.

Within three months' time there was sufficient regrowth of papillomatous material to occlude the larynx. Difficulty with respiration was noted at any time mucus obstructed the tracheotomy tube. During the latter part of April and early May, 1956, she was given Premarin under supervision of the endocrinologist. This, however, was abandoned after approximately two weeks on further consideration of systemic effects.

Some regrowth was evident on examination during June and again in September, 1956. On these two occasions it was necessary to remove a moderate amount of polypoid material from the larynx, because she was relying entirely on the tracheotomy tube for respiration.

Removal of the papillomatous masses became necessary again on December 5, 1956. Following this treatment a course of bovine wart vaccine was begun. Doses of .1 cc., .3 cc., .5 cc., and .5 cc. again were given at three day intervals through December 26.

In February, 1957, it became evident that her voice, instead of diminishing in volume and clarity during the next two or three weeks, had gradually improved. By mirror examination it was thought that the cords were clear.

In March, 1957, direct laryngoscopy was again carried out and showed the larynx to be free of papillomata. She was given an additional 1 cc. dose of bovine wart vaccine at this time.

During April and May, 1957, she appeared to have some difficulty intermittently with respiration and an occasional squeaky voice during upper respiratory infections. On July 9, 1957, no papillomata were seen on direct laryngoscopy. The glottic chink appeared adequate, although there was some suggestion of webbing of the anterior commissure. The tracheotomy tube was removed.

Subsequent examinations through the remainder of the year suggested a clear larynx. During the summer months, however, it became evident that there was a well-defined webbing of the anterior commissure. This was treated by incision of the web and retention of an acrylic plate between the vocal cords, for a five-week period of healing. This was removed during July, 1958, and the voice was excellent for two or three months, when a sudden episode of hoarseness developed. On laryngoscopy and re-examination at this time, a small inflammatory granuloma was

\*The applicator was prepared by Dr. Joe D. Steed; surface radiation was measured directly, and dosage time of application computed.

removed from the site of the previous acrylic implant. Following this, the voice remained satisfactory and airway good for the remainder of the year.

*Case 2.* M.O. was first hospitalized at the age of two-and-a-half years on Dec. 6, 1955. He was seen in the hospital emergency room after an apparent "asthma" of six weeks' duration, which became progressively worse. A tracheotomy was required as an emergency procedure. Two weeks later direct laryngoscopy was carried out, and a large papillomatous mass was observed to fill the anterior half of the glottic chink, with extensions posteriorly on the right side; these masses were avulsed. Papilloma of the larynx was diagnosed microscopically. After a few days of observation the tracheotomy tube was removed and he was released from the hospital with a good voice and respiratory exchange. Tetracycline drugs were given during hospitalization with instructions to continue these for approximately six weeks after release from the hospital.

Three months later he was doing well and had very little change in his voice.

Six-and-a-half months later he developed some hoarseness, for which he was hospitalized and re-examined by direct laryngoscopy (June 18, 1956). A small amount of papillomatous material was avulsed and podophyllum was applied to the larynx. He was again instructed to use tetracycline orally for four to six weeks.

He did not return for four months (November, 1956), at which time he had developed an upper respiratory infection and had some difficulty in breathing. After antibiotic drugs for several days, direct laryngoscopy was carried out again; tracheotomy became necessary during the procedure. Recurrent papillomata were seen and removed. He was released from the hospital with the tracheotomy tube in place on Dec. 7, 1956, approximately one year after his first hospitalization. Oral tetracycline drugs were again employed. Later in the month indirect laryngoscopy suggested a slight recurrence of papillomata.

During February, some hoarseness was again evident, during which time satisfactory mirror visualization of the larynx was not obtained. Bovine wart vaccine was given, with a test dose on Feb. 22, and .5 cc. on March 1.

He was hospitalized on March 8, 1957, with the tracheotomy tube still in place. On laryngoscopic examination a well-defined pad of papilloma was noted attached to the area of the posterior commissure, with smaller paddings along the ventricular band. Cupped forceps were again employed to avulse all visible tumor tissue in the larynx. Following his release from the hospital, he did not return for continuation of the bovine papilloma vaccine.

Hospitalization was arranged again June 12, 1957, at which time he was wearing the tracheotomy tube satisfactorily, and was able to wear a plug in the tracheotomy tube indefinitely. A well-developed regrowth of papillomatous masses was noted, and was removed. Several days of tetracycline medication were given during hospitalization and apparently used for a few days after leaving the hospital.

During July and early August he was returned to the office; and, on these occasions did receive a definitive amount of vaccine. Doses of 1 cc. at weekly intervals were given for four weeks, followed by a final dose on Aug. 16, of 1.5 cc. of the vaccine.

Hospitalization was again arranged on Sept. 24, 1957. At this time a very small amount of papillomatous tissue was noted on both sides of the anterior commissure. These were removed, and an additional dose of vaccine was given while in the hospital.

Following this, he was talking quite well, and examination by direct laryngoscopy was arranged for Dec. 30, 1957. On this occasion the larynx was clear and the tracheotomy tube was removed.

On March 15, 1958, approximately five months after his last dose of vaccine, he was hospitalized for repair of tracheal fistula. The larynx was examined at this time without indication of recurrence of papillomata.

*Case 3.* D.M., a three-year-old white female, was first seen on July 18, 1958, for hoarseness since the preceding February, followed by loss of voice. She had been seen elsewhere and was advised that there was a "growth inside the voice box," for which laryngoscopy was recommended.

She was hospitalized and direct laryngoscopy carried out. Anesthesia could not be used because of obvious retraction of the chest on any excitement or effort. On exposure of the larynx with the direct laryngoscope, the anterior one-half of the glottic chink was filled with an irregular nodular mass. A large portion appeared to be pedicled from the anterior commissure. This central mass was grasped with forceps, and a sufficiently large mass of tissue was removed for restoration of the airway. Microscopic study subsequently reported benign squamous papilloma.

Following intradermal tests on the same day, bovine wart vaccine, 0.3 cc. was given. Two days later an additional 0.6 cc. was given. She was released from the hospital with excellent restoration of the airway, and a hoarse voice. Two additional doses of bovine wart vaccine in 1 cc. injections were given during subsequent weekly intervals.

She was hospitalized again after a 28-day interval. At this time the voice was still husky. On direct examination there was a marked diminution in the amount of papilloma present. A 3 or 4 mm. mass was noted in the anterior commissure and another similar sized mass in the mid-cordal area on one side. Following avulsion of these masses, the voice was of fair quality. An additional 1 cc. of bovine wart vaccine was given.

She was seen again after an interval of three months. She had done very well except that the voice was intermittently somewhat hoarse. At this time, examination of the larynx showed rounding effect in the anterior commissure, somewhat suggestive of webbing. A biopsy taken from this area reported no papillomata.

Tetracycline drugs were employed for four to five days, only at the time of hospital admissions.

*Case 4.* M.Z. was first seen on July 15, 1958, at the age of 14 years, with a complaint of persistent hoarseness. Papilloma of the larynx had been discovered at the age of six, during the course of clinical investigation of the cause for convulsions in his sleep. He had had an abnormal voice from the time he learned to speak. Papillomatous masses were removed from the larynx at this time, and he did fairly well for the next five or six years. During the last two years, however, he had had laryngoscopy and removal of recurrent papillomata on three occasions. The last procedure had not improved his voice. An abnormal voice was impairing his school activities psychologically, and at the same time he had excessive dread of further laryngeal procedures.

On examination of the larynx there was a well-defined pad of papillomatous material in the anterior commissure, and a small mass on one arytenoid and the opposite ventricular band.

Initial medical treatment consisted of aureomycin, which was continued for 30 days. At the same time he was given estrogens for inhalation by nebulizer. Around the first of September, 1958, the estrogen was discontinued and a mixture of corticosteroids with antibiotic substituted.

During medical therapy no change was noted in the appearance of the larynx.

On Sept. 26 direct laryngoscopy was carried out, and the mass in the anterior commissure and extending along the anterior cord was removed. To permit observation, a small patch of papilloma situated on the top of the ventricular band was not disturbed. Bovine wart vaccine injections were started, the doses being given at weekly intervals starting with 1 cc., then 1.5 cc., and finally 2 cc.

Postoperatively, the voice was definitely improved but lacked good quality. During the succeeding month, however, his voice continued to improve. Re-examination on Oct. 11, 1958, showed a very slight webbing in the anterior commissure and the area of papilloma which had not been excised had disappeared spontaneously.

#### ADDENDUM TO CASE HISTORIES.

*Case 3.* D.M., showed recurrence of papillomata on re-examination, April 14, 1959. A course of chick embryo wart vaccine and tetracycline drugs during the next two months was negative, without effect. An autogenous vaccine is being attempted by Dr. E. W. Irvine, Jr., Wichita Falls, Tex.

Dr. W. P. Anthony, Fort Worth, Tex., reports the use of bovine vaccine in two cases, with considerable regression in one instance, and no effect in the second.

#### COMMENT.

With the exception of Case 3, prolonged courses of wide spectrum antibiotics were employed. For this case, use of antibiotics was deliberately limited to a few days postoperatively or during the course of acute infections.

In 1950, Holinger and his associates<sup>2</sup> reported on the use of aureomycin therapy in heavy doses and prolonged administration for control of recurrences of papilloma of the larynx. He reported seven cases which had shown regression in the growth. In 1951,<sup>3</sup> he reported two additional cases and noted that a clear larynx had been obtained in three cases treated in the first group, and there was a regression in the growths of the remaining four.

Shortly after the publication of Holinger's first paper, I had occasion to treat a two-and-a-half-year-old white male by this method with success.

Capps<sup>4</sup> surveyed treatment of papilloma of the larynx by circulating a questionnaire to a number of colleagues. He concluded that no presently accepted therapy will control this disease. The various treatments advocated are listed. He

notes the frequency with which stenosis of the larynx results from violation of the anterior commissure surgically. Webbing of the anterior commissure became a definite problem in Case 1.

Webb<sup>5</sup> reported five cases of papilloma of the larynx which were treated with antibiotics; and, in particular, aureomycin. Profiles of 15 additional unpublished cases treated at the State University of Iowa Hospitals were given. He concluded "that massive and long-continued antibiotic therapy, with aureomycin in particular, effectively supplements surgery in the treatment of laryngeal papilloma."

In two of the reported cases, podophyllum applications to the larynx were made without evident influence upon the course of the disease. Hollingsworth and his associates<sup>6</sup> reported successful treatment of five children with podophyllum applied locally to the laryngeal masses. In previous personal experience with two adult recurrences of papillomata, one case appeared to be markedly benefited by repeated topical application of podophyllum, while another case was uninfluenced by this method of treatment.

Successful topical hormone therapy was reported by Broyles.<sup>7</sup> Amniotin in oil was applied by spraying a solution directly into the larynx with resultant clearing of papillomata. Five cases were presented in the five to seven-year-old age group. More recently, Szpunar<sup>8</sup> reported treatment by the injection of .1 to .5 mls. of Stilbestrol into one or the other side of the larynx at a time.

Silverblatt<sup>9</sup> reported three cases of multiple papillomata of the larynx treated by topical spraying of antibiotic-steroid combination with the arrest of actively recurring papillomatosis.

Both the topical spray of estrogens and the use of antibiotic-steroid combinations in the larynx were employed in Case 4, for a few weeks, without evident effect upon the disease.

Schultz<sup>10</sup> in 1908, reported transfer of bovine papilloma to humans. Ullman<sup>11</sup> demonstrated a successful inoculation of laryngeal papilloma by means of cell-free filtration extract

into the skin of a human, and he also transmitted this as an infectious process to the vaginal mucosa of a dog.

More recently, Webb<sup>5</sup> and Pinsker<sup>12</sup> reviewed the literature supporting the possibility of viral etiology of papilloma of the larynx and presented presumptive evidence for the presence of a virus in papilloma. Ono<sup>13</sup> and his associates discussed the etiology of multiple papilloma and considered the possibilities of hormonal, chronic irritation, and virus infections in this condition. Clinical and experimental observations were thought to point to a virus as the most causative factor. Warren<sup>14</sup> indicated that a filtrable agent was responsible for warts; and, furthermore, suggested that a single etiologic agent probably was responsible for the different types of warts; *i.e.*, cutaneous, genital and laryngeal. He stated that warts of dogs and cattle are not transmissible to man.

Amarante<sup>15</sup> mentioned studies in progress in vaccinothrapy for recurrent papillomatosis in the adult. A general acceptance of the high probability of virus etiology in papilloma of the larynx suggests a possible efficacy of the use of vaccines.

Whether papillomatosis was arrested in the cases presented as a result of the use of bovine wart vaccine is open to question. Jackson<sup>16</sup> presented multiple papillomata of the larynx as a "benign self-limited disease." He established two classes of cases: "1. Those in which the growth gets well spontaneously, or with slight treatment, surgical or other, and 2. those not readily amenable to any form of treatment, recurrence appearing persistently at the old sites and in entirely new locations." The time required for freedom from recurrences was stated as months, or a year or two.

#### SUMMARY.

Four cases of papilloma of the larynx are reported. Wart vaccine of bovine origin, as well as other commonly used measures, was employed during the course of treatment.

Recurrences of the disease were arrested following administration of vaccine therapy.

Further studies are necessary to determine whether the



reported cases became arrested fortuitously, or as a result of therapy.

## REFERENCES.

1. KILLINGER, ARDEN, H., M.D., Ft. Dodge, Ia.: Personal communication.
2. HOLINGER, PAUL H.; JOHNSTON, KENNETH C., and ANISON, GEORGE C.: Papilloma of Larynx; Review of 109 Cases with Preliminary Report of Aureomycin Therapy. *Ann. Otol., Rhinol. and Laryngol.*, 59:547-564, June, 1950.
3. HOLINGER, PAUL H.: *Ann. Otol., Rhinol. and Laryngol.*, 60:496, June, 1951.
4. CAPPS, F. C.: Benign Tumors of the Larynx. *Jour. Laryngol. and Otol.*, 71:709-711, Nov., 1957.
5. WEBB, W. E.: Papillomata of the Larynx. *THE LARYNGOSCOPE*, 66:871, July, 1956.
6. HOLLINGSWORTH, J. B.; KOHLMOSS, H. W., and MCNAUGHT, R. C.: Treatment of Juvenile Papilloma of the Larynx with Resin or Podophyllum; Preliminary Report. *Arch. Otolaryngol.*, 52:82-87, July, 1950.
7. BROYLES, EDWIN N.: Treatment of Laryngeal Papilloma in Children with Estrogenic Hormone; Preliminary Report. *Bull. Johns Hopkins Hosp.*, 66:319, May, 1940.
8. SZPUNAR, J.: Treatment of Papillomatosis of the Larynx in Children. *Acta Otolaryngol.*, 47:369-374, April, 1957.
9. SILVERBLATT, BERNARD L.: The Use of Antibiotic-Steroid Combinations as Nebulizing Agent in the Treatment of Laryngeal Conditions; Preliminary Report. *THE LARYNGOSCOPE*, 68:1081-1086, June, 1958.
10. SCHULTZ, F.: Experimental Transmission of Verruca Vulgaris from Cattle to Man with Extraordinarily Long Incubation. *Deutsche Med. Zin. Wochenschr.*, 34:423, 1908.
11. ULLMAN, E. V.: On the Etiology of Laryngeal Papilloma. *Acta Otolaryngol.*, 5:317, 1925.
12. PINSKER, OSCAR T.: Studies on the Etiology of Papilloma of the Larynx. *Arch. Otolaryngol.*, 67:268-269, March, 1958.
13. ONO, J.; SAITO, H.; IGARASHI, M., and ITO, M.: The Etiology of Papilloma of the Larynx. *Ann. Otol., Rhinol. and Laryngol.*, 66:1119-1142, Dec., 1957.
14. WARREN, JOEL: "Warts; Verruca in Viral and Rickettsial Infections of Men," Edited by Thomas M. Rivers, 2nd Ed., p. 669.
15. AMARANTE, RUBEN C. L.: *Arch. Otolaryngol.*, 59:94, July, 1953.
16. JACKSON, CHEVALIER: "Bronchoscopy and Esophagoscopy," 2nd Ed., pp. 270-272, 1927.

## AN EVALUATION OF PATIENTS SUSPECTED OF HAVING NOISE INDUCED HEARING LOSS.\*

RALPH N. KRAUS, Colonel, USAF(MC)FS

Brooks Air Force Base, Tex.

The term *noise-induced hearing loss* will be used in this paper to refer to the hearing loss that results from repeated exposure to noise over a period of months or years.<sup>11</sup> The term, as used here, excludes hearing loss caused by physical trauma to the head or ears, explosion, or excessive changes in barometric pressure.

The relationship of hearing loss to noise exposure has been reported by many investigators since the report of Fosbroke in 1831.<sup>1,4,8,10,15</sup> Most of these reports are concerned with prolonged exposure to fairly constant sound-pressure levels of moderate intensity. Davis<sup>6</sup> was of the opinion that there is no rigid proof of permanent impairment of hearing from noise of less than 115 to 120 db. Exposure to 130 to 136 db white noise at the borax wells of Tuscany has caused hearing loss of moderate severity after 100 days of exposure.<sup>3</sup>

Jet aircraft engine mechanics and other flight-line personnel are routinely, although intermittently, exposed to high-intensity noise during the performance of their normal duties. One present day jet engine produces noise with an overall sound-pressure level of approximately 140 db (see Fig. 1).

A recent research study of personnel exposed to jet-engine noise failed to show a significant correlation between such exposure and hearing loss, although a positive correlation between age and hearing loss was demonstrated.<sup>12</sup>

Barron<sup>2</sup> concluded, "Serial audiometric studies of 470 flight-line mechanics exposed to reciprocating and turbojet engine noise for periods up to seven years while employed in an air-frame manufacturing company are reported. There was no

\*Presented as a Candidate's Thesis to the American Laryngological, Rhinological and Otological Society, 1959.

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication Feb. 3, 1959.

significant change in the mean or median tests for the group at 1,000 or 4,000 cps frequencies other than those generally associated with presbycusis."

In another report<sup>16</sup> on subjects exposed to jet-engine noise who had been observed for five years, it was concluded that, "There is considerable indication that a certain steady-state

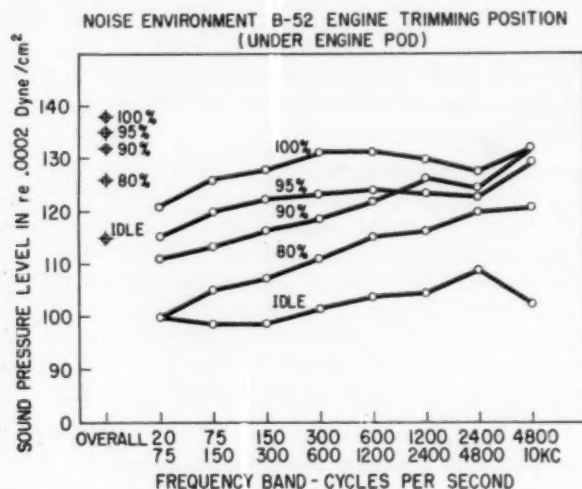


Fig. 1.

jet-engine noise with intensity fluctuations between 90 and 120 db and with sound energy predominantly in the frequencies below 600 cps is not hazardous to the hearing of exposed personnel. None of the changes in hearing occurring in any of the subjects in this study can definitely be attributed to exposure to jet-engine noise."

The clinician is frequently called upon to determine whether a patient's hearing level\* is caused or aggravated by noise exposure. He may be requested to give an opinion as to

\*The term "hearing level" is used here in the sense suggested by Davis, Hoople and Parrack<sup>1</sup> and refers to "... the deviation in decibels of an individual's threshold of hearing from the American Standard value for the reference zero for audiometers."

whether or not continuing at the present job or assignment may cause a change for the worse in the patient's hearing. It should be emphasized that studies of the type reported above involve groups of individuals and are not of appreciable assistance in arriving at a correct diagnosis or recommendation for disposition in a specific individual.

This report will point out the importance of obtaining a detailed history, performing a thorough physical examination, and administering hearing tests before making a decision.

Because of these early reports it was expected that United States Air Force personnel who are exposed to jet-engine noise would develop hearing loss. The requirement for a Hearing Conservation Program was recognized by the United States Air Force and AFR 160-3, first published in 1949 and revised in October, 1956, specifically relates to hazardous noise exposure. According to the regulation, the limits for lifetime exposure are as follows:

"The limits for lifetime exposure to broad band noise are given in terms of the band pressure level for four octave bands. The four octave bands are 300-600 c.p.s., 600-1200 c.p.s., 1200-2400 c.p.s., and 2400-4800 c.p.s. In setting limits, it is assumed that the ears are protected and exposed continuously during normal work hours over a period of twenty-five years. The risk of damage to hearing is slight when the pressure level of a band does not exceed 85 db. It increases as the band pressure level increases and is excessive at 95 db."

The regulation requires that a Hearing Conservation Data Card (AF Form 1490) including a pure-tone threshold audiogram be obtained on everyone suspected of receiving a hazardous noise exposure prior to assignment to his job. This baseline audiogram is designated as the reference audiogram. As a practical expedient, all individuals who work on the flight-line are presumed to receive a hazardous noise exposure. The reasons for requiring a pure-tone threshold audiogram, rather than a screening audiogram, has been reported elsewhere.<sup>13</sup> The audiometric frequencies required to be tested are: 500, 1000, 2000, 3000, 4000, and 6000 cps. The regulation specifies that the audiograms be classified as Class A, B, or C. Class A means that there is no threshold loss greater than 15 db for any of the above frequencies; in other words, the hearing level is 15 db or better. Class B means that the hearing level is poorer than Class A but not as poor as Class C. Class C

means that the hearing level is an average of 20 db or more for the speech frequencies (500, 1000, and 2000 cps) in *either* ear. A copy of AF Form 1490 is sent to the Central Hearing Conservation Data Card Repository at the School of Aviation Medicine, USAF. An analysis of 43,536 of these forms, for both military and civilian personnel, reveals the following: Class A, 52 per cent; Class B, 43 per cent; Class C, 5 per cent<sup>17</sup> (see Table I). The breakdown for military personnel compares favorably with a similar analysis made under research conditions.<sup>12</sup> The greater losses in the civilian group is probably due to the advanced age of this group.

TABLE I.

Unpublished Data from the United States Air Force Hearing Conservation Data Card Repository.

	A	B	C	Total
Military—	17,923 58%	12,015 39%	934 3%	30,872
Civilian—	4,434 35%	6,862 54%	1,368 11%	12,664

Most flight-line personnel now on duty with the United States Air Force have not had an audiogram prior to noise exposure. The current regulation provides that individuals who are now trained and have a Class C classification on their reference (baseline) audiogram should be retested after 15 hours away from noise. If the retest shows that the audiogram is still Class C another test is given after 40 hours away from noise. If the audiogram remains Class C after 40 hours away from noise, it is recommended that the individual be referred to a Diagnostic Hearing Center for evaluation.

This evaluation is to determine whether the individual should be allowed to continue at his present duties or be transferred to a noise-safe area which, in all probability, means retraining in another career field (job). The transfer of individuals trained for flight-line duties into other career fields could, if a sufficient number are involved, interfere with the Air Force mission. Because of the seriousness of this decision it was felt that the evaluation of these individuals

with a Class C audiogram or significant threshold shift should be made by a physician with special training in this field of medicine. The number of otolaryngologists in the United States Air Force is very limited. A hospital is designated as a Diagnostic Hearing Center only when a Board-certified or Board-eligible otolaryngologist is assigned to that hospital. It is desirable that a clinical audiologist also be assigned to these Centers. The Centers are located throughout the United States and overseas areas so that their services are available without prolonged travel on the part of the patient.

The School of Aviation Medicine, USAF, was designated as a Diagnostic Hearing Center October 29, 1956. The author has had the privilege of evaluating a small number of Air Force personnel who were presumed to have received hazardous noise exposures and who were found to have had a Class C audiogram at their duty station. They were trained personnel whose length of military service varied from less than one year to over thirty years. A reference audiogram was not available on any of the patients.

Among the factors considered to be important in the evaluation were the medical history, occupational history, family history, physical examination, hearing tests, estimate of actual noise exposure, and presbycusis.

Items considered of particular interest in the medical history were: hearing loss since childhood; meningitis or systemic infection; mumps; head injury with drainage of blood from the ear, loss of consciousness or vertigo; injury to the ear from foreign body, blast or blow to the ear; earache, drainage from the ear or decreased hearing associated with a common cold or following aerial flight; medications known to have an effect on hearing, such as streptomycin, dihydrostreptomycin, quinine and others; awareness of hearing loss by the patient and time of onset; and, finally, results of previous physical examinations and hearing tests.

The occupational history included: military history; hunting or frequent use of firearms; previous employment, particularly concerning noise exposure; present assignment, length of time on the present assignment; tinnitus and/or

temporary threshold shift at the end of a work day or work week.

The family history was obtained with reference to defective hearing. When the history was positive, an evaluation of other members of the family would have been of inestimable value in arriving at a diagnosis.

The physical examination was carefully performed. Particular attention was given to evidence of disease or injury, active or healed, of the external ear, middle ear, and Eustachian tube, which might affect hearing. The fact that fluid in the middle ear may cause a high-tone loss simulating a perceptive loss was kept in mind.<sup>14</sup> In unilateral perceptive type cases a caloric test was carried out. The effect of age on auditory acuity was considered.<sup>4,5</sup>

The hearing tests were performed in a room in which the ambient noise is such that it does not mask the true audiometric thresholds. Suitable standards for ambient noise within the test booth have been suggested by the Subcommittee on Noise in Industry of the American Academy of Ophthalmology and Otolaryngology.<sup>9</sup>

A pure-tone threshold air conduction and bone conduction audiogram constituted the minimum hearing test. The tests were performed on an audiometer which was calibrated according to the specifications prepared by the American Standards Association. Speech reception threshold and discrimination tests are an invaluable adjunct in evaluating the patient's hearing for speech. Speech tests were done whenever indicated. The speech reception threshold was obtained using laboratory equipment and the W-2 recordings. The discrimination score was obtained using the same equipment and Russ-Hughes recordings. The scores on normal individuals in our laboratory range between 75 per cent and 85 per cent. A recruitment test may aid in differentiating between cochlear and retrocochlear perceptive type losses; however, it is a difficult test to perform when the loss in both ears is equal. All tests were performed by an individual with special training in hearing testing.

As a result of procedures such as those outlined above,



77 cases referred to the Diagnostic Hearing Center, School of Aviation Medicine, USAF, were diagnosed as follows:

1. Conductive .....	29
a. Otitis media, chronic (active or healed) .....	11
b. Otosclerosis .....	17
c. Atresia, external auditory meatus, congenital .....	1
2. Functional .....	7
a. Psychogenic .....	2
b. Voluntary (Malingering) .....	5
3. Perceptive .....	41
a. Unilateral .....	22
b. Bilateral .....	19

#### COMMENTS.

It was felt that noise exposure definitely was not the main cause for a Class C audiogram in the conductive cases.

With reference to the functional cases, the hearing level of the two psychogenic cases may have been contributed to indirectly by noise exposure, but a basic psychiatric disturbance was in operation. The five diagnosed as voluntary functional cases were found to have essentially normal hearing after repeated tests.

The perceptive type cases were categorized as being unilateral or bilateral. Medical histories of the unilateral perceptive cases were revealing. Of the 22 unilateral cases, nine patients gave a history of head injury with loss of consciousness and each was aware of defective hearing following it; nine gave a history of defective hearing since childhood, cause unknown; one patient had experienced a sudden loss of hearing while on furlough; and three could not date the onset of defective hearing although each individual stated that he had been aware of it for several years. One patient who had no history of head trauma had an absent caloric response and unilateral deafness. He was referred for a neurological consultation because of the possibility of acoustic neuroma. In none of the unilateral perceptive types was noise exposure felt to be the main cause for a Class C audiogram.

Since only the bilateral perceptive type cases are now

suspected of noise-induced hearing loss, it is felt that a presentation of the audiometric findings and a brief extract of the pertinent history of these cases is in order.

*Case 1.* F.W.E., M/Sgt., age 38. The patient worked as a conventional aircraft mechanic from 1942 to 1956. During 1956 and 1957 he was "line chief" for a squadron of F-89's. He first noted hearing loss nine months ago.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	25	25	25	25	50	65	NR	NR	17	78
Left	20	25	30	35	60	65	NR	NR	24	80
BC - Right	20	20	20	20	NR	NR				
Left	20	20	40	35	NR	NR				

*Case 2.* C.B.R., civilian, age 42. The patient has worked as a conventional aircraft mechanic for 17 years. Defective hearing was noted during his physical examination for separation from the Navy in 1945. He does not feel handicapped socially or at work by defective hearing. He gives no history of temporary threshold shift after a work day.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	5	20	60	NR	NR	NR	NR	NR	46	24
Left	0	15	65	NR	NR	NR	NR	NR	45	22
BC - Right	5	10	65	NR	NR	NR				
Left	10	20	65	NR	NR	NR				

*Case 3.* J.D.P., T/Sgt., age 34. The patient has 16 years' military service. He was a conventional aircraft mechanic until 1955. Since then he has been a jet mechanic. He has noted defective hearing for several years.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	0	15	35	65	75	80	70	55	36	44
Left	0	15	45	65	75	75	NR	55	36	52
BC - Right	0	25	30	NR	NR	NR				
Left	10	30	45	NR	NR	NR				

*Case 4.* R.A.Z., A/2C, age 22. The patient was exposed to considerable heavy weapons fire while in an Army artillery division during the Korean Conflict. He noted defective hearing and tinnitus at the time of discharge from the Army. He enlisted in the United States Air Force April 22, 1957.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	25	40	35	40	65	70	70	40	37	70
Left	25	35	40	40	65	75	75	50	35	64
BC - Right	30	45	35	35	NR	NR				
Left	25	35	35	35	NR	NR				

*Case 5.* A.B.M., civilian, age 58. The patient retired from the Army in 1950 after 30 years' active service. He has fired small weapons frequently all his life. He worked as a conventional aircraft mechanic during most of his military career. Since retirement he has worked as a Civil Service employee doing the same type of work.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	10	20	40	55	65	60	55	45	34	52
Left	5	30	50	60	65	60	55	55	41	44
BC - Right	-10	-10	20	50	NR					
Left	-10	-10	40	55	NR	NR				

Case 6. E.R., civilian, age 44. The patient has been a conventional aircraft mechanic for 12 years. He has noted defective hearing for two or three years.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	0	10	25	50	70	60	40	45	32	60
Left	10	10	30	60	70	65	50	55	30	52
BC - Right	10	20	30	50	NR	NR				
Left	10	0	15	NR	NR	NR				

Case 7. R.M.M., civilian, age 54. The patient has been a conventional aircraft mechanic for the past 11 years. There is no other history of noise exposure. He occasionally has high-pitched tinnitus.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	15	15	25	35	45	50	55	20	25	68
Left	5	10	20	30	45	50	50	30	20	88
BC - Right	20	30	35	35	40	45				
Left	10	20	30	35	45	40				

Case 8. R.H.H., M/Sgt., age 50. The patient has 16 years' military service. He was in the infantry for 15 months in World War II, during which time he was frequently exposed to machine gun, carbine, and howitzer fire. He has been aware of defective hearing since 1945.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	10	25	35	45	60	75	65	70	24	72
Left	15	30	40	65	65	75	60	65	43	52
BC - Right	15	25	35	50	NR	NR				
Left	20	35	45	NR	NR	NR				

Case 9. R.O.B., A/2C, age 26. While he was in the Army in 1951, a 90 or 120 mm. howitzer was fired near the patient. He had tinnitus for eight hours following this. He hunts frequently. From December, 1956, to June, 1957, he was exposed almost daily to small arms fire on a rifle range. Since June, 1957, he has been exposed to jet-aircraft noise.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	20	30	30	35	55	60	60	55	36	64
Left	35	35	35	35	60	60	65	55	38	60
BC - Right	25	35	35	45	55	55				
Left	25	30	30	35	60	55				

Case 10. W.F.F., S/Sgt., age 27. The patient was a weapons mechanic for eight and one-half years. He first noted defective hearing while in Korea in 1951. He was bore-sighting 50 calibre machine guns on F-86 type aircraft. He was exposed to 8,000 to 12,000 rounds a day for one year. He had tinnitus for two or three hours every evening but noted no temporary threshold shift.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	15	20	40	60	55	50	50	50	24	48
Left	20	15	25	50	55	55	55	40	23	70
BC - Right	15	15	40	50	55	50				
Left	5	15	40	30	55	45				

*Case 11.* D.J.F., A/3C, age 21. The patient has had 38 months' service in the United States Air Force. He has done armament work for 12 months. He fires small arms frequently. He has had pure-tone type tinnitus since childhood and has had recurrent episodes of otitis media. He had a simple mastoidectomy on the left as a child. Examination revealed marked scarring of the tympanic membranes.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	15	25	30	20	70	70	60	55	28	76
Left	15	20	25	45	75	75	70	50	33	66
BC - Right	5	10	20	20	NR	NR				
Left	-	5	30	35	NR	NR				

*Case 12.* D.D.F., S/Sgt., age 23. The patient has been a jet mechanic for five and one-half years. His grandmother wears a hearing aid. There has been no significant change in his audiogram between May, 1957, and December, 1957.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	-5	10	20	50	50	45	35	35	18	66
Left	-10	5	15	50	50	50	40	40	13	82
BC - Right	10	20	50	55	NR					
Left	10	20	NR	NR	NR					

*Case 13.* H.A.S., M/Sgt., age 36. The patient developed a "humming, buzzing-type ringing" in the left ear following a flight from Japan to California in October, 1957. The patient has been aware of defective hearing since then. His father has defective hearing.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	15	20	45	45	50	55	65	30	41	54
Left	15	15	35	50	65	60	65	45	43	48
BC - Right	20	35	50	35	NR	45				
Left	20	20	30	NR	NR	NR				

*Case 14.* H.W.N., S/Sgt., age 48. The patient has had 15 years' military service. He was assigned with the Air Police for three years but rarely fired a weapon. For the past three months he has worked in a hangar close to T-37 type operating aircraft. He is unaware of defective hearing. He rarely flies. His father has defective hearing.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	0	10	20	25	50	65	70	80	18	86
Left	0	10	25	25	40	40	50	55	25	82
BC - Right	10	15	20	30	55	NR				
Left	5	-5	5	30	40	55				

*Case 15.* R.C., T/Sgt., age 27. From 1947 to 1955 the patient worked as a mechanic on conventional aircraft. During 1955 and 1956, he was a

mechanic on the B-47 type multiple jet bomber. He has had no serious noise exposure since 1956. Both parents have defective hearing.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	55	70	65	60	65	55	50	45	67	50
Left	35	35	40	25	25	25	15	30	37	44
BC - Right	35	25	50	50	50	45				
Left	15	15	25	30	30	15				

*Case 16.* M.W.B., T/Sgt., age 28. The patient quit a job in a factory while in high school because the noise made him nervous. In 1949 he had mumps. During his hospitalization an audiogram was performed and revealed defective hearing. His father had defective hearing at an early age. He has a brother and sister who have defective hearing. The paternal grandfather has defective hearing.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	20	20	30	45	50	55	50	45	37	44
Left	10	20	30	45	50	55	55	45	32	48
BC - Right	25	30	NR	NR	45					
Left	25	35	45	45	50					

*Case 17.* M.R.C., A/IC, age 25. When the patient was 12 years old, a firecracker accidentally exploded close to his ear. He had temporary threshold shift and tinnitus for several hours afterward. Prior to entering the United States Air Force he was employed for six years in aircraft companies as a sheet metal worker, riveter and punch press operator. He operated a jack hammer for six months. He is now a B-36 mechanic but is rarely exposed to noise.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	5	5	5	15	75	75	75	50	5	50
Left	15	25	NR	NR	NR					
BC - Right	0	0	-10	15						
Left	20	15	NR	NR						

*Case 18.* W.J.B., A/2C, age 22. The patient is an air policeman who works as a security guard on the flight line. He was an aircraft mechanic in the Navy from 1952 to 1955. He is unaware of defective hearing. In 1949 he had a head injury which resulted in loss of consciousness for 20 minutes.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right	10	15	20	25	50	50	30	40	19	60
Left	0	10	20	20	30	30	20	25	14	74
BC - Right	5	0	20	25	55	40				
Left	5	10	25	30	20	25				

*Case 19.* M.L.H., S/Sgt., age 26. The patient has six years' military service. During this period he has done aircraft sheet metal work and used riveting machines and sheet metal presses. He has noted some difficulty in understanding speech for about two years. He does not feel that his hearing loss is progressive. At age 15 he had a head injury with loss of consciousness for two minutes.

	250	500	1000	2000	3000	4000	6000	8000	SRT	Discrimination
AC - Right .....	-5	-5	10	70	75	80	NR	NR	13	72
Left .....	-5	5	15	60	75	95	NR	80	13	50
BC - Right .....	0	-10	5	NR	NR	NR				
Left .....	0	10	15	NR	NR	NR				

## DISCUSSION.

Inasmuch as reference audiograms had not been done on these patients, it was impossible to determine whether there had been a threshold shift. (Since March 10, 1957, every individual entering the United States Air Force has had a pure-tone threshold audiogram as part of his routine physical examination.) The audiometric curves obtained on many of the patients were not of the type usually found in noise-induced hearing loss.

It is suspected that poor hearing probably had been present for many years in those patients who stated that they were unaware of hearing loss. A family history of hearing loss was obtained from a few of them. At present, it is impossible to determine whether most of these patients had actually received a hazardous noise exposure. With equipment now available, the duration of an individual's exposure to a given sound-pressure level on a flight-line can not be measured conveniently or accurately because the noise level fluctuates almost continually, and personnel move into and out of the noise areas sporadically. Most of these patients were returned to their previous assignments. All of them were urged to wear ear protection, and they were requested to return in one year for further evaluation. It is hoped that an evaluation of these individuals after they have been an additional year at their normal place of duty will prove rewarding.

## SUMMARY.

The results of an evaluation of 77 United States Air Force flight-line personnel with defective hearing are reported. The evaluation revealed that 29 patients had a conductive type, seven had a functional type, and 41 had a perceptive type defect. Twenty-two of these perceptive cases were unilateral. In only 19 cases was noise exposure con-

sidered to be a possible cause of defective hearing. The difficulties encountered in attempting to determine whether defective hearing in a specific patient is caused or aggravated by noise exposure are discussed.

#### CONCLUSIONS.

The greatest difficulty encountered in evaluating these patients was the lack of a reference audiogram. Until a method or a device is developed to measure the noise exposure each individual receives, or until it is proved that intermittent exposure to high-intensity noise causes hearing loss, the judgment of the examining physician will be greatly taxed in determining whether the hearing level in a specific patient is caused or aggravated by noise exposure but, careful history-taking and medical examination are needed to rule out other influences. By obtaining detailed histories, performing thorough physical examinations, and administering hearing tests, it was possible to eliminate 58 out of 77 patients with Class C hearing who were suspected of having a noise-induced hearing loss.

#### REFERENCES.

1. American Standards Association Exploratory Subcommittee Z24-X-2: "The Relations of Hearing Loss to Noise Exposure." American Standards Assn., Inc., New York, 1954.
2. BARBON, C.: Audiometric Studies of Flight Line Mechanics. *Jour. Aviation Med.*, 28:295-302, 1957.
3. BERNABEI, LUIGI: "Sulla Sordita Professionale da Rumore Bianco." (From Translations of the Beltone Institute for Hearing Research, No. 1, Nov., 1955.) *Revista di Audiologia Pratica*, Milan, Armo III, Numero 1-2-3, 1953.
4. Benox Report: "An Exploratory Study of the Biological Effects of Noise." The University of Chicago, Dec. 1, 1953.
5. BUNCH, C. C.: Age Variations in Auditory Acuity. *Arch. Otolaryngol.*, 9:625-636, 1929.
6. DAVIS, H.: Protection of Workers Against Noise. *Jour. Indust. Hyg. and Toxicol.*, 25:56-57, 1945.
7. DAVIS, H.; HOOPLE, G. D., and PARRACK, H. O.: The Medical Principles of Monitoring Audiometry. *Arch. Indust. Health*, 17:1-20, 1958.
8. FOSBROKE, J.: Practical Observations on the Pathology and Treatment of Deafness. *Lancet*, 19:645-648; cited by KRYTEL, K. D., *Jour. Speech and Hear. Disorders*, *Mogr. Supp.* 1, p. 37, 1950.
9. GLORIG, A.: Guide for Conservation of Hearing in Noise. *Amer. Acad. Ophthal. and Otolaryngol.*, revised 1957.



10. GLORIG, A.; WHEELER, D.; QUIGGLE, R.; GRINGS, W., and SUMMERFIELD, A.: 1954 Wisconsin State Fair Hearing Survey. *Amer. Acad. Ophthal. and Otolaryngol.*, 1957.

11. GLORIG, A.: "Noise and Your Ear." Crane & Stratton, New York, 1958.

12. KOPRA, L. L.; BRIDGES, C., and SIEGELMAN, M.: Hearing Acuity of Air Force Flight-line Personnel: A Preliminary Report. *School of Aviation Medicine, USAF*, Report No. 57-73, July, 1957.

13. KRAUS, R. N.: The Air Force Hearing Conservation Program. *School of Aviation Medicine, USAF*, Review No. 3-58, Sept., 1957.

14. PROETZ, A. W.: Hearing Acuity Varying with the Position of the Head. *Ann. Otol., Rhinol. and Laryngol.*, Vol. 57, March, 1948.

15. SATALOFF, J.: "Industrial Deafness" McGraw-Hill Book Co., Inc., New York, 1957.

16. SATALOFF, J.: Effect of Prolonged Exposure to Intense Noise on Hearing Acuity. *Arch. Otolaryngol.*, 58:62-80, 1953.

17. WALDRON, D. L.: "Central Repository for Hearing Conservation Data, On Examination of the First Year's Reporting." *School of Aviation Medicine, USAF*, Review 3-59, Oct., 1958.

School of Aviation Medicine, USAF.

Brooks Air Force Base, Tex.

---

#### AMERICAN SOCIETY OF FACIAL PLASTIC SURGERY.

The meeting of the American Society of Facial Plastic Surgery will be held December 9, 1959, at the Hotel Elysee, 60 East 54th Street, New York City.

Program: Plastic Surgical Management of Facial Lesions, by Bernard E. Simon, M.D.; Dermabrasion—A Re-appraisal by Irwin I. Lubowe, M.D.; Discussion, Norman Orentreich, M.D.

## PB INTELLIGIBILITY AND WORD FAMILIARITY.

CHARLES HUTTON, Ph.D.,\*

and

JOHN WEAVER, B.S.,†

Champaign, Ill.

In the construction of the original PB-lists by Egan,<sup>3</sup> the variables given primary consideration were phonetic content and word familiarity. When the lists became popular in hearing testing, clinical observations indicated that there were still many unfamiliar words, necessitating modifications such as that by Haskins<sup>4</sup> and Hudgins.<sup>7</sup> In the revision and re-recording of the PB-lists by Hirsh et al.,<sup>5</sup> further attempts were made to equalize word familiarity; however, because of the recent finding by Howes<sup>6</sup> that familiarity is the single most important variable in word intelligibility, it would seem that more attention should be given to this aspect of test construction. Further, if it is assumed that the relative frequency of occurrence is the best index of word familiarity, it should be noted that specific information about word familiarity is available, spanning the pre-school age,<sup>1</sup> elementary age,<sup>8</sup> and adult age levels.<sup>9</sup> The present study is an attempt, prompted by clinical observation, to examine variations in word familiarity of the PB W-22 word lists at these lower age levels.

### PROCEDURE.

The 200 words in the PB W-22 lists<sup>2</sup> were ranked according to frequency of occurrence in the Thorndike-Lorge general count<sup>9</sup> and the total occurrence in Rinsland's elementary school list.<sup>8</sup> The words chosen for this study are presented in Table I and consist of the 15 words that were rated highest and the 15 words that were rated lowest in frequency of occur-

\*Charles Hutton (Ph.D., Illinois, 1954) is Supervisor of Aural Rehabilitation, University of Illinois Hearing Center.

†John Weaver (B.S., Illinois, 1956) is a Speech Correctionist in Champaign School System.

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication Aug. 16, 1958.

TABLE I.

The 15 Most Familiar and the 15 Least Familiar PB W-22 Words,  
According to the Thorndike-Lorge General Count and  
the Rinsland Total Count.

PB Word	Thorndike-Lorge*	Rinsland†
and	AA	203,146
you	AA	102,426
we	AA	93,444
in	AA	88,782
it	AA	83,344
of	AA	81,620
is	AA	79,025
have	AA	57,102
my	AA	55,267
are	AA	49,699
he	AA	47,225
on	AA	42,058
they	AA	41,863
that	AA	39,497
she	AA	31,361
tan	14	166
jam	16	109
chew	14	102
ache	28	100
ham	17	84
chin	27	67
jaw	11	58
carve	26	54
knit	30	53
deaf	19	47
all	5	0
shove	15	26
darn	12	18
pew	5	0
ace	3	0

\*The number of occurrences per million words; AA is the highest rating given and indicates 100 or more occurrences per million.

†The number of times the word occurs in the first eight grades.

rence. Rather arbitrary decisions were made concerning the choice of several of the least familiar words. Examination of the phonetic content of these two sets of words indicates that the more familiar words have a smaller number of phonemes and a smaller vowel to consonant ratio, both of which should operate to increase word intelligibility.

Fifty-three public school students were used as subjects, all of whom were receiving speech therapy at the time of the study. Two students were hard of hearing, the remaining 51 had normal hearing by pure frequency audiometry. Four of the subjects were in kindergarten, 22 in the first grade, nine

from the second grade, three seventh graders, two eighth, one ninth, two tenth, five eleventh, and five twelfth graders. All had normal intelligence.

The students were brought in, one at a time, to a sound-treated therapy room for testing purposes. The 30 words were presented at a conversational level, live voice, in a random order by the junior author, who was the speech correctionist for the students. Each listener was told that he would be given a listening test consisting of 30 words. The speaker said each word only once and the listener was instructed to repeat the word he heard. The speaker wrote down the response to each stimulus word. Because of the sometimes complicating speech defects of the subjects, responses were quantified in the following manner: When the response was not clearly audible or was distorted, the subject was asked to explain the meaning of the word. For example, if the stimulus word was "carve" and the listener's response was "car," he was asked to explain the word he had just said. If the explanation was that it was something to ride in, then a "car" response was recorded as an error; however, if the explanation was that it was something you do with a knife, then "car" was recorded as a correct response.

#### RESULTS.

The number of times each of the 30 words was incorrectly identified is presented in Table II. It can be seen that only three of the most familiar words were missed more than once, while 14 of the 15 least familiar words were missed more than once. Application of the sign test<sup>2</sup> indicates that the differences in number of incorrect responses between the two sets of words are significant at the 1 per cent level. It seems unlikely that the differences in phonetic content of the two lists could produce such results. Examination of the nine grade columns shows that most of the response errors took place at the lower three grade levels; in fact, all of the 19 errors on the most familiar words and about three-fourths of the errors on the least familiar words occurred at the kindergarten and first grade levels. The regularity of the age effect

TABLE II.

Number of Incorrect Responses for the 15 Most Familiar and the 15 Least Familiar Words in the PB W-22 List.

Number of Listeners		4	22	9	3	2	1	2	5	Sum
										5-53
PB Word	Kind.	Grade								
		1	2	7	8	9	10	11	12	
and	1	2	0	0	0	0	0	0	0	0-3
you	0	0	0	0	0	0	0	0	0	0-0
we	0	0	0	0	0	0	0	0	0	0-0
in	1	0	0	0	0	0	0	0	0	0-1
it	0	1	0	0	0	0	0	0	0	0-1
of	0	1	0	0	0	0	0	0	0	0-1
is	0	1	0	0	0	0	0	0	0	0-1
have	2	1	0	0	0	0	0	0	0	0-3
my	0	0	0	0	0	0	0	0	0	0-0
are	0	0	0	0	0	0	0	0	0	0-0
he	1	0	0	0	0	0	0	0	0	0-1
on	0	0	0	0	0	0	0	0	0	0-0
they	1	5	0	0	0	0	0	0	0	0-6
that	0	1	0	0	0	0	0	0	0	0-1
she	0	1	0	0	0	0	0	0	0	0-1
Errors/listener	1.5	0.6	0	0	0	0	0	0	0	19
tan	4	8	3	0	0	0	0	0	0	0-15
jam	1	15	3	0	0	1	0	1	0	0-21
chew	0	5	1	0	0	0	0	0	0	0-6
ache	3	8	1	0	0	0	0	0	0	0-12
ham	1	3	0	0	0	0	0	0	0	0-4
chin	0	0	0	0	0	0	0	0	0	0-0
jaw	3	13	5	0	0	0	0	1	1	1-23
carve	4	22	5	0	0	1	0	0	0	0-32
knit	2	9	2	0	0	0	0	0	0	0-12
deaf	3	15	7	2	0	1	1	2	3	3-34
ail	4	10	4	0	0	0	0	0	0	0-18
shove	3	11	3	0	0	0	0	0	0	0-17
darn	4	19	6	0	0	0	0	0	0	0-29
pew	3	11	2	0	0	0	0	0	0	0-16
ace	1	4	1	1	0	0	0	0	0	0-7
Errors/listener	9.0	7.0	4.8	1.0	0	3.0	.5	.8	.8	247

can be seen in the tendency toward a decrease in number of errors per child as grade level increased.

While there are other words in the PB W-22 word lists that are low in frequency of occurrence, the above results seem to indicate that differences in word familiarity on these lists would usually not have a large effect on discrimination scores at higher age levels; however, at kindergarten and

lower elementary grade levels, there are substantial differences between the two word familiarity extremes. In the writers' opinion the size of these differences is great enough to cause serious concern about the use of the PB W-22 lists and recordings in hearing testing at lower age levels. In addition to the above data, it should be noted that while 135 of the 200 W-22 words are AA words, many of these, *e.g.*,

TABLE III.

Number of Incorrect Responses on the Least Familiar and the Most Familiar PB W-22 Words for Individual Listeners at the Lower Three Grade Levels.

Listener	Kindergarten		First Grade		Second Grade	
	Least	Most	Least	Most	Least	Most
1	10	1	11*	0	7	0
2	9	4	10	1	6	0
3	8	1	10	1	6	0
4		0	10	1	5	0
5			9	0	5	0
6			8	2	5	0
7			8	2	4	0
8			8	0	4	0
9			8	0	1*	0
10			8	0		
11			7	0		
12			7	0		
13			6	0		
14			6	0		
15			6	0		
16			5	3		
17			5	1		
18			5	0		
19			5	0		
20			4	1		
21			4	0		
22			3	1		

\*Hearing of Hearing.

"else," are unfamiliar to children. Of course, the clinician who is testing children can use such procedures as trying to teach the unfamiliar words to the client prior to testing, but such procedures are at best, time consuming, and of doubtful validity with hearing-handicapped children.

Further demonstration of the differences between the least familiar and most familiar PB words can be seen by examining the listener data for the three lower grade levels. While it is apparent from inspection of Table II that the small num-

ber of errors on the most familiar words would not produce large differences between individual listeners, the data in Table III indicate that there are substantial differences between listeners on the least familiar words. It would seem unlikely that these differences could be due to variations in sound discrimination ability among the listeners, since the rank positions of the listeners on the two sets of words are substantially different. For instance, in the first grade the first seven listeners made seven errors on the most familiar words,

TABLE IV.

Number of More Familiar and Less Familiar Responses on the 15 Least Familiar PB W-22 Words. Ratings Based on the Thorndike-Lorge General Count; Responses for the Lower Three Grade Levels. Responses (Incorrect) Grades: Kindergarten, One and Two.

PB Word	More	Less	Total
tan .....	14	0	14
jam .....	18	1	19
chew .....	6	0	6
ache .....	10	2	12
ham .....	4	0	4
chin .....	0	0	0
jaw .....	21	0	21
carve .....	30	1	31
knit .....	10	2	12
deaf .....	22	3	25
ail .....	18	0	18
shove .....	16	1	17
darn .....	29	0	29
pew .....	11	5	16
ace .....	5	1	6
	214	16	230

the middle eight listeners made no errors on these words, and the last seven listeners made six errors. At the same time the number of errors on the least familiar words was progressively decreasing. Thus the least familiar words did not distinguish between listeners in the same direction as the most familiar words. The explanation for this would seem to be that the least familiar words test the vocabulary as well as the sound discrimination ability of the client. In multiple presentations, as in hearing aid evaluations, we may, in part, be testing the client's ability to use new words quickly. Per-



haps these data may be a partial explanation for the variability encountered in some testing situations.

An indication of the importance attached to word familiarity by the listener can be found by looking at their incorrect responses. The response errors, except for word fragments, to the least familiar words are summarized in Table IV. Only the data for the lower three grade levels are reported here. The frequency of occurrence of each of the incorrect responses was located in the Thorndike-Lorge general count and compared with the rating of the stimulus word. In 214 out of 230 such comparisons, the response word was more familiar than the stimulus word. Similar results were found using rankings from Rinsland. Certainly, this is a clear indication of the confounding effect of word familiarity in discrimination testing with PB words.

#### SUMMARY AND CONCLUSIONS.

In an attempt to quantify clinical observations about unfamiliar words in the PB W-22 lists, the 15 least familiar and 15 most familiar words were presented to a group of 53 public school students from kindergarten age to twelfth grade. The conclusions are as follows:

1. The 15 least familiar words were less intelligible than the 15 most familiar words.
2. Intelligibility increased as age increased, especially for the least familiar words at lower age levels.
3. The least familiar words did not distinguish between listeners in the same direction as the most familiar words.
4. The incorrect responses to the least familiar words were higher in frequency of occurrence than the PB words, a further indication of the confounding effect of word familiarity on discrimination testing.
5. These data cast serious doubt on the use of the PB W-22 words at pre-school and lower elementary school ages. It is suggested that these data may also be a partial explanation for the variability encountered in some clinical situations.

## REFERENCES.

1. ANONYMOUS: A Study of the Vocabulary of Children before Entering the First Grade. *Child Study Committee of the International Kindergarten Union*; mimeograph.
2. DIXON, W. J., and MASSEY, F. J.: "Introduction to Statistical Analysis." McGraw-Hill, New York, 1951.
3. EGAN, J. P.: Articulation Testing Methods. *THE LARYNGOSCOPE*, 58:955-991, 1948.
4. HASKINS, H.: "A Phonetically Balanced Test of Speech Discrimination for Children." M.A. Thesis, Northwestern University, 1949.
5. HIRSH, IRA J., ET AL.: Development of Materials for Speech Audiometry. *Jour. Speech and Hear. Disord.*, 17:321-337, 1952.
6. HOWES, DAVIS: On the Relation Between the Intelligibility and Frequency of Occurrence of English Words. *Jour. Acoust. Soc. of Amer.*, 29, 1957.
7. HUDGINS, C. V.: A Method of Appraising the Speech of the Deaf. *Volta Review*, 51:597-638, 1949.
8. RINSLAND, H. D.: "Basic Vocabulary of Elementary School Children." MacMillan, New York, 1947.
9. THORNDIKE, E. L., and LORGE, I.: "The Teacher's Hand Book of 30,000 Words." Columbia U. Press, New York, 1944.

328 Illini Hall.

---

#### TEMPLE UNIVERSITY POSTGRADUATE COURSES.

Postgraduate course in laryngology and laryngeal surgery, April 4th to 15th, and September 26th to October 7th, 1960.

Postgraduate course in bronchoesophagology, February 1st to 12th, and November 7th to 18th, 1960.

These courses are to be given in the Department of Laryngology and Bronchoesophagology, Temple University Medical Center, under the direction of Drs. Chevalier L. Jackson and Charles M. Norris.

The tuition fee for each course is \$250. Application and information may be obtained by writing to: Jackson-Research, Lab 604, Temple University Medical School, 3400 N. Broad street, Philadelphia 40, Pa.

## A TECHNIQUE FOR SPLINTING FRACTURES OF THE STAPES CRURA.\*

DAVID MYERS, M.D.,  
Philadelphia, Pa.

One of the frequent complications in mobilization of the stapes, whatever the technique employed, is a fracture of one or both of the crura. This is a very distressing complication, since it will nullify any good results obtained by mobilization. In a number of patients, fracture of one of the crura was united with and splinted by means of a minute piece of plastic tubing, which was used to surround the fractured crura and hold it together. This technique is submitted for your consideration.

*Case 1.* Mrs. G. had a previous mobilization procedure three-and-one-half years ago. At that time, the Zeiss loupe was used for magnification. I thought that mobility had been achieved, without greater magnification; however, I was unable to inspect the entire footplate and ossicular chain. The patient's hearing did not improve postoperatively, and she was not seen again until she returned for revision on Dec. 19, 1958. At the operation, it was found that this patient had a localized otosclerosis, which involved the anterior crus (Grade I, Bellucci). After careful dissection, using the 16X power of the Zeiss operating microscope, it was revealed that what was thought to be mobility at the first operation was actually a fracture of the posterior crus in its lower third. With the use of a small chisel, the entire footplate was freed. Good mobility was visualized and the patient's hearing improved immediately; however, a fracture of the anterior crus also resulted. Because of the considerable motility of the crura, due to the fractured crura, the idea occurred that I might be able to splint the fracture of the posterior crus. I fashioned a piece of No. 90 plastic tubing (see Fig. 1) and found that this would easily fit around the fractured crus. The tube was made long enough so that it touched the footplate and lenticular process of the incus. Once the tube was applied it embraced the posterior crus, surrounded it, and held it firmly. The plastic tubing is elastic and contracts after it is applied. The patient's hearing increased tremendously because of the improved columellar effect and an excellent result was obtained (see Fig. 2).

*Case 2.* Mrs. H.A. This patient had a Grade II otosclerosis. The surgical technique employed was that of anterior crurotomy. When pressure with the Shea anterior crurotomy knife was applied, a shearing action took place, which twisted and fractured the posterior crus just above the junction with the footplate. The mucosal covering of the stapes held the fracture together, but the entire joint was very feeble, since

\*From the Department of Otorhinology, Temple University Medical Center.

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication Feb. 15, 1959.

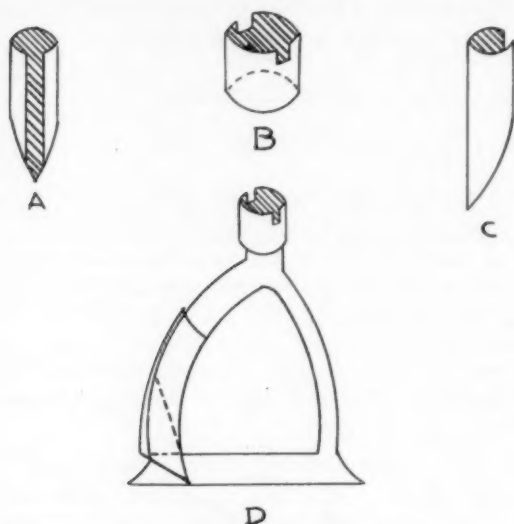


Fig. 1. a. and c.—Diagrammatic sketch indicates shape of plastic splint. The shape and cut can be varied with the location of the fracture. d.—Indicates mode of application. b.—Indicates a plastic couplet used to unite the disarticulated incus and stapes.

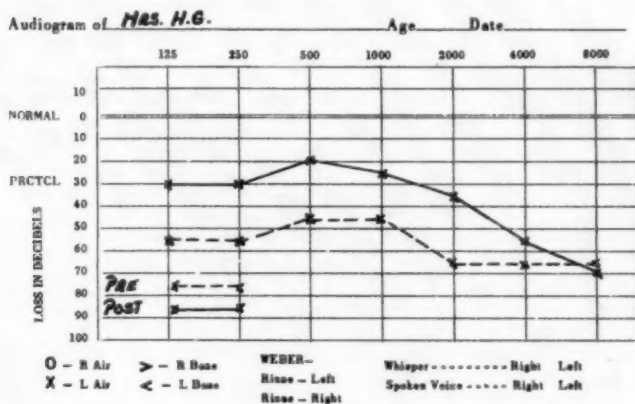


Fig. 2.

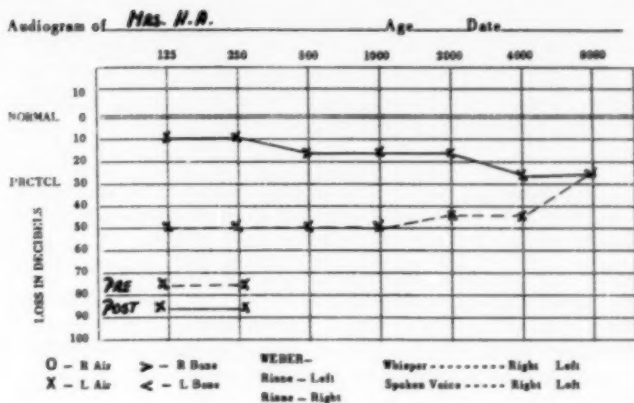


Fig. 3.

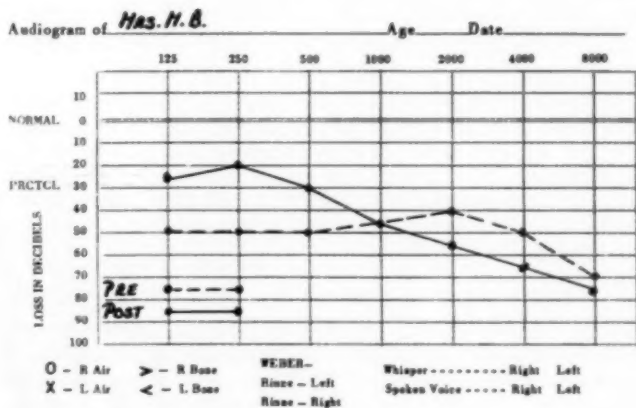


Fig. 4.

both crura were now fractured. Utilizing the experience of Case 1, a minute piece of plastic tubing was used and fashioned to form a splint. The posterior border of the fossa ovalis could be outlined. The end of the plastic splint was pointed and inserted into the joint and used to surround the crura. This held perfectly and the patient's hearing improved (see Fig. 3).

Case 3. Mrs. B. In this patient, a stapes mobilization had been carried out on April 28, 1956. There was no improvement of hearing, despite the

fact that I thought I had achieved mobilization. On revision, with the use of the Zeiss microscope and adequate magnification, it was discovered that there actually was a fracture of the posterior crus and disarticulation of the stapes from the incus. There was localized otosclerosis. The footplate was cut free, a splint was applied to the posterior crus, and a couplet to the stapes head, which was notched so that the incus could fit into it. When the columellar effect of the stapes was re-united, the patient's hearing improved (see Fig. 4).

#### CONCLUSION.

A technique is presented in which No. 90 plastic tubing is used to repair fractures of the crura. A splint is made with plastic tubing and used to surround the fractured crura. This can be carried out with relative ease and is a technique which can be used to salvage cases in which this complication occurred. It is also possible to use this idea to unite the disarticulated incudostapedial articulation by fashioning a couplet to unite these two fractures. The idea developed after I had developed a facility with this tubing after using it during the performance of the Shea vein graft technique.

3701 N. Broad Street.

---

#### ANNOUNCEMENT.

The Annual Spring Meeting of the Alumni Association of the New York Eye and Ear Infirmary will take place April 4-7, 1960.

The meeting will be oriented towards pediatric otolaryngology. Symposia will be offered on: Nystagmus as a Pediatric Problem; Diagnosis and Rehabilitation of Hearing Problems in Children; and Ankylosis of the Stapes. There will also be a closed circuit television demonstration of surgical procedures. In addition, courses will be offered in: Allergy and Immunology in Children; X-ray Diagnosis in Ear and Sinus Problems in Children; Pediatric Laryngeal Problems, and Secretory Otitis Media in Children.

Additional information may be obtained by writing to Dr. John R. Finlay, Secretary, Alumni Association, 218 Second avenue, New York 3, N. Y.

## A MODIFIED AURAL SPECULUM FOR USE DURING MYRINGOTOMY.

MERRILL LINEBACK, M.D.,

College Park, Ga.

Frequently during the performance of a myringotomy the depths of the canal will fill with blood from the incised drum and completely obscure it. When this occurs, the procedure must be stopped and an adrenalin-soaked sponge or gauze triangle tip placed deep in the canal until bleeding ceases.

It was with this situation in mind that the medium sized aperture Gruber aural speculum was modified by having a No. 14 needle silver-soldered to the outside at the site of greater diameter at the distal end. The needle is cut flush with each end of the speculum (see Fig. 1, No. 1). Through this outside needle is passed a short length of Adams polyethylene tubing PE-90 which fits snugly. To the proximal end of the tubing a No. 20 needle is slipped, as shown at No. 2 in Fig. 1. To the proximal end of this needle is attached a House adapter as shown at No. 3. When the assembled unit is attached to rubber tubing and to the lower arm of the "Y," shown at No. 4 in Fig. 2, it will provide the suction and aspiration necessary to remove obscuring blood. Since the polyethylene tubing slips easily through the No. 18 needle, the depth of placement can readily be modified to suit the infant or adult canal.

The paracentesis end of the opposite arm of the "Y" consists of the Senturia aspirator, No. 2, Fig. 2, to which is attached a No. 19 spinal needle. The base of the "Y" attaches either to wall suction or to aspirating machine. The cut-offs, No. 3 and No. 5, are used to prevent or allow suction as needed.

When in place, the outside soldered needle lies along the inferior part of the external canal. The Storz magnifying operating loupe may be used with the speculum to provide

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication Feb. 15, 1959.



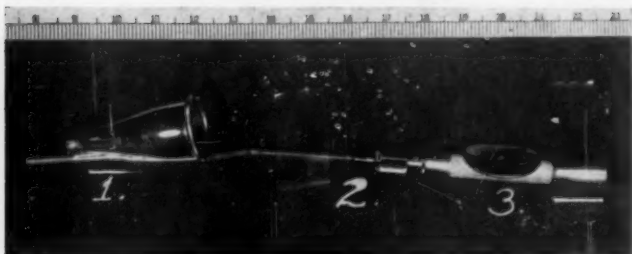


Fig. 1. The modified Gruber medium sized speculum with a No. 14 needle silver-soldered on the outside as shown at 1. At 2 is the Adams PE 90 tubing with a No. 20 needle inserted, and at 3 is the House connector.

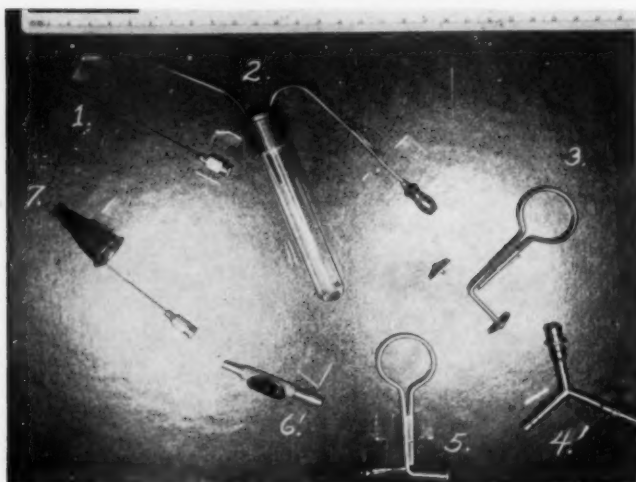


Fig. 2. The author's set-up for suction during myringotomy and paracentesis. 1, 2 and 3 is the modified Senturia suction biopsy and aspiration end of the "Y"; at 5, 6 and 7 is the new modification suction speculum to maintain a dry field in the canal depths. The rubber tubing is omitted for clarity.

more precise viewing of the drum head. The modified speculum should prove useful during tympanoplasties and possibly the transtympanic approach to the labyrinth and stapes by simply turning the speculum 180 degrees so that the tubing now lies in the superior area of the external canal. By the

same token, application of liquid medication is facilitated during the treatment of infections deep in the external canal also involving the myrinx. This modification of the Gruber aural speculum is obtainable from the Storz Instrument Company, 4570 Audubon Ave., St. Louis 10, Mo., and from Estes Surgical Supply Co., 56 Auburn Ave., N. E., Atlanta, Ga.

124 West Princeton Avenue.

---

#### POSTGRADUATE COURSE.

The next postgraduate course in Laryngology and Bronchoesophagology to be given by the University of Illinois College of Medicine is scheduled for the period April 4 to 16, 1960. The course is under the direction of Dr. Paul H. Holinger.

Interested registrants will please write directly to the Department of Otolaryngology, University of Illinois College of Medicine, 1853 West Polk Street, Chicago 12, Ill.

## DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES.

(Secretaries of the various societies are requested to keep this information up to date).

### AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

President: Dr. Erling W. Hansen, 90 So. Ninth St., Minneapolis, Minn.  
Executive Secretary: Dr. William L. Benedict, Mayo Clinic, Rochester, Minn.  
Meeting: Palmer House, Chicago, Ill., October, 1960.

### AMERICAN ASSOCIATION FOR CLEFT PALATE REHABILITATION.

President: Dr. J. J. Longacre, 1503 Carew Tower, Cincinnati, O.  
President-Elect: Dr. D. C. Samuel Pruzansky, D.D.S., 840 So. Wood St., Chicago, Ill.  
Secretary-Treasurer: Dr. Spriestersbach, Ph.D., Department of Otolaryngology, University Hospital, Iowa City, Ia.  
Meeting: Palace Hotel, Denver, Colo., May 12-14, 1960.

### AMERICAN BOARD OF OTOLARYNGOLOGY.

President: Dr. Gordon D. Hoople, 1100 E. Genesee Dr., Syracuse 10, N. Y.  
Secretary: Dr. Dean M. Lierle, University Hospital, Iowa City, Ia.  
Meeting: Chicago, Ill., October, 1960.

### AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION.

President: Dr. Verling K. Hart, 107 W. 7th St., Charlotte, N. C.  
Vice-President: Dr. Daniel C. Baker, Jr., 903 Park Ave., New York, N. Y.  
Secretary: Dr. F. Johnson Putney, 1712 Locust St., Philadelphia 3, Pa.  
Treasurer: Dr. Charles M. Norris, 3401 Broad St., Philadelphia, Pa.  
Meeting: Deauville Hotel, Miami Beach, Fla., March 15-16, 1960 (Afternoons only).

### AMERICAN LARYNGOLOGICAL ASSOCIATION.

President: Dr. W. J. McNally, Montreal, Canada.  
Secretary: Dr. Lyman G. Richards, Wellesley Hills, Mass.  
Treasurer: Dr. Francis E. LeJeune, New Orleans, La.  
Editor, Historian, and Librarian: Dr. Edwin N. Broyles, Baltimore, Md.  
Meeting: Deauville Hotel, Miami Beach, Fla., March 18-19, 1960.

### AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

President: Dr. Theo. E. Walsh, 640 So. Kingshighway, St. Louis 10, Mo.  
President-Elect: Dr. Fletcher D. Woodward, 400 Locust Ave., Charlottesville, Va.  
Secretary: Dr. C. Stewart Nash, 700 Medical Arts Bldg., Rochester 7, N. Y.  
Treasurer: Dr. K. M. Day, 121 University Pl., Pittsburgh, Pa.  
Annual Meeting: Deauville Hotel, Miami Beach, Fla., March 13-19, 1960.

**AMERICAN MEDICAL ASSOCIATION,  
SECTION ON LARYNGOLOGY, OTOTOLOGY AND RHINOLOGY.**

Chairman: Dr. Paul H. Hollinger, Chicago, Ill.  
Vice-Chairman: Dr. Lawrence R. Boies, Minneapolis, Minn.  
Secretary: Dr. Walter E. Heck, San Francisco, Calif.  
Representative to Scientific Exhibit: Dr. Walter H. Maloney, Cleveland, Ohio.  
Section Delegate: Dr. Gordon F. Harkness, Davenport, Ia.  
Alternate Delegate: Dr. Dean M. Lierle, Iowa City, Ia.  
Meeting: Miami Beach, Fla., June 13-17, 1960.

**AMERICAN OTOTOLOGICAL SOCIETY, INC.**

President: Dr. R. C. Martin, 384 Post St., San Francisco 8, Calif.  
Secretary: Dr. Lawrence R. Boies, University Hospitals, Minneapolis 14, Minn.  
Meeting: Deauville Hotel, Miami Beach, Fla., March 13-14, 1960.

**AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT  
OF PLASTIC AND RECONSTRUCTIVE SURGERY.**

President: Dr. Joseph Gilbert, 111 E. 61st St., New York, N. Y.  
Vice-President: Dr. Kenneth Hinderer, 402 Medical Arts Bldg., Pittsburgh, Pa.  
Secretary: Dr. Louis Joel Felt, 66 Park Ave., New York 16, N. Y.  
Treasurer: Dr. Arnold L. Caron, 36 Pleasant St., Worcester, Mass.

**AMERICAN RHINOLOGIC SOCIETY.**

President: Dr. Kenneth H. Hinderer, 402 Medical Arts Bldg., Pittsburgh 13, Pa.  
Secretary: Dr. Robert M. Hansen, 1735 No. Wheeler Ave., Portland 17, Ore.  
Annual Clinical Session: October 8-9, 1959, Illinois Masonic Hospital, Chicago, Ill.  
Annual Meeting: October 10, 1959, Belmont Hotel, Chicago, Ill.

**AMERICAN SOCIETY OF FACIAL PLASTIC SURGERY.**

President: Dr. Oscar J. Becker, Chicago, Ill.  
Vice-President: Dr. Sam H. Sanders, Memphis, Tenn.  
Treasurer: Dr. Joseph C. Miceli, Brooklyn, N. Y.  
Secretary: Dr. Samuel M. Bloom, 123 E. 83rd St., New York 28, N. Y.  
Meeting: Chicago, Ill., October, 1960.

**AMERICAN SOCIETY OF OPHTHALMOLOGIC AND  
OTOLARYNGOLOGIC ALLERGY.**

President: Dr. Michael H. Barone, Buffalo, N. Y.  
President-Elect: Dr. Walter E. Owen, Peoria, Ill.  
Vice-President: Dr. Frank P. Powers, Raleigh, N. Car.  
Secretary-Treasurer: Dr. Daniel S. DeStio, 121 S. Highland Ave., Pittsburgh 6, Pa.  
Annual Meeting:

**ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—  
CAMPINAS.**

President: Dr. Alberto Gallo.  
First Secretary: Dr. Alfredo Martinelli.  
Second Secretary: Dr. Guedes de Melo Neto.  
Librarian-Treasurer: Dr. L. de Souza Queiroz.  
Editors for the Archives of the Society: Dr. Antonio de Almeida, Dr. Gabriel Pôrto, and Dr. Roberto Franco do Amaral.

**ASOCIACION DE OTORRINOLARINGOLOGIA  
Y BRONCOESOFAGOLOGIA DE GUATEMALA.**

Presidente: Dr. Julio Quevedo, 15 Calle Oriente No. 5.  
First Vice-Presidente: Dr. Héctor Cruz, 3a Avenida Sur No. 72.  
Second Vice-Presidente: Dr. José Luis Escamilla, 5a Calle Poniente No. 48.  
Secretario-Tesorero: Dr. Horace Polanco, 13 Calle Poniente No. 9-D.

**ASOCIACION DE OTO-RINO-LARINGOLOGIA DE BARCELONA, SPAIN.**

Presidente: Dr. J. Abello.  
Vice-Presidente: Dr. Luis Suñe Medan.  
Secretario: Dr. Jorge Perelló, 319 Provenza, Barcelona.  
Vice-Secretario: Dr. A. Pinart.  
Vocal: Dr. J. M. Ferrando.

**BALTIMORE NOSE AND THROAT SOCIETY.**

Chairman: Dr. Walter E. Loch, 1039 No. Calvert St., Baltimore, Md.  
Secretary-Treasurer: Dr. Theodore A. Schwartz.

**BUENOS AIRES CLUB OTOLARINGOLOGICO.**

Presidente: Dr. K. Segre.  
Vice-Presidente: Dr. A. P. Belou.  
Secretario: Dr. S. A. Aranz.  
Pro-Secretario: Dr. J. M. Tato.  
Tesorero: Dr. F. Games.  
Pro-Tesorero: Dr. J. A. Bello.

**CANADIAN OTOLARYNGOLOGICAL SOCIETY  
SOCIETE CANADIENNE D'OTOLARYNGOLOGIE.**

President: Dr. G. Arnold Henry, 170 St. George St., Toronto, Ontario.  
Secretary: Dr. Donald M. MacRae, 324 Spring Garden Rd., Halifax, Nova Scotia.  
Meeting: Sheraton-Brock Hotel, Niagara Falls, Ontario.

**CENTRAL ILLINOIS SOCIETY OF OPHTHALMOLOGY  
AND OTOLARYNGOLOGY.**

President: Dr. William F. Hubble, Decatur, Ill.  
President-Elect: Dr. Charles D. Sneller, Peoria, Ill.  
Vice-President: Dr. Edgar T. Blair, Springfield, Ill.  
Delegate at Large: Dr. G. Leroy Porter, Urbana, Ill.  
Secretary-Treasurer: Dr. Clarence A. Fleischli, Springfield, Ill.

#### **CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.**

President: Dr. George Woodruff, Woodruff Clinic, Joliet, Ill.  
Vice-President: Dr. Linden Wallner, 122 So. Michigan, Chicago, Ill.  
Secretary-Treasurer: Dr. Robert Lewy, 25 East Washington St., Chicago  
2, Ill.  
Meeting: First Monday of each month, October through May.

#### **CHILEAN SOCIETY OF OTOLARYNGOLOGY.**

President: Dr. Enrique Grünwald S.  
Vice-President: Dr. Agustín Estartus.  
Secretary: Dr. Marcos Chaimovich S.  
Treasurer: Dr. Benjamin Kaplan K.  
Director: Dr. Alberto Basterrica A.

#### **COLORADO OTOLARYNGOLOGY SOCIETY.**

President: Dr. James T. Blair, Denver, Colo.  
Vice-President: Dr. James Rigg, Grand Junction, Colo.  
Secretary: Dr. Will P. Pirkey, Denver, Colo.

#### **COLUMBUS, OHIO, OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY.**

President: Dr. John E. Arthur.  
Secretary: Dr. M. L. Battles.  
Meetings: First Monday of October through May, University Club, Colum-  
bus, O.

#### **DALLAS ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.**

President: Dr. Edward A. Newell.  
Vice-President: Dr. Thomas M. McCrory.  
Secretary-Treasurer: Dr. James L. Baldwin, 1627 Medical Arts Bldg.,  
Dallas, Tex.

#### **FEDERACION ARGENTINA, DE SOCIEDADES DE OTORRINOLARINGOLOGIA.**

Secretary of the Interior: Prof. Dr. Atilio Viale del Carril.  
Secretary of the Exterior: Dr. Aldo G. Remorino.  
Secretary Treasury: Prof. Dr. Antonio Carrascosa.  
Pro-Secretary of the Interior: Prof. Dr. Carlos P. Mercandino.  
Pro-Secretary of the Exterior: Prof. Dr. Jaime A. del Sel.  
Pro-Secretary of the Treasury: Dr. Jorge Zubizarreta.

#### **FIRST CENTRAL AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY.**

President: Dr. Victor M. Noubleau, San Salvador.  
Secretary-Treasurer: Dr. Hector R. Silva, Calle Arce No. 84, San Salva-  
dor, El Salvador, Central America.

#### **FLORIDA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.**

President: Dr. G. Dekle Taylor, Jacksonville, Fla.  
President-Elect: Dr. Kenneth S. Whitmer, Miami, Fla.  
First Vice-President: Dr. William H. Anderson, Jr., Ocala, Fla.  
Second Vice-President: Dr. Marion W. Hester, Lakeland, Fla.  
Secretary-Treasurer: Dr. Joseph W. Taylor, Jr., 1 Davis Blvd., Tampa 6,  
Fla.

**FOURTH LATIN-AMERICAN CONGRESS OF  
OTORINOLARINGOLOGIA.**

President: Dr. Dario.  
Secretary:  
Meeting:

**FORT WORTH EYE, EAR, NOSE AND THROAT SOCIETY.**

President: Dr. Van D. Rathgeber.  
Vice-President: Dr. William Skokan.  
Secretary-Treasurer: Dr. Paul Rockwell.

**GREATER MIAMI EYE, EAR, NOSE AND THROAT SOCIETY.**

President: Dr. Mariano C. Caballero.  
Vice-President: Dr. Joseph Freeman.  
Secretary-Treasurer: Dr. H. Carlton Howard.  
Meeting: Quarterly in March, May, October and December on the second  
Thursday of the month, 6:30 P.M., at the McAllister Hotel, Miami, Fla.

**INTERNATIONAL BRONCHOSOPHAGOLOGICAL SOCIETY.**

President: Dr. Jo Ono, Tokyo, Japan.  
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40,  
Pa., U. S. A.  
Meeting:

**KANSAS CITY SOCIETY OF OTOLARYNGOLOGY  
AND OPHTHALMOLOGY.**

President: Dr. Clarence H. Steele.  
President-Elect: Dr. Dick H. Underwood.  
Secretary: Dr. James T. Robison, 4620 J. C. Nichols Parkway, Kansas  
City, Mo.  
Meeting: Third Thursday of November, January, February and April.

**LOS ANGELES SOCIETY OF OPHTHALMOLOGY  
AND OTOLARYNGOLOGY.**

President: Dr. Max E. Pohlman.  
Secretary-Treasurer: Dr. Wendell C. Irvine.  
Chairman of Ophthalmology Section: Dr. Carroll A. McCoy.  
Secretary of Ophthalmology Section: Dr. Philip D. Shanedling.  
Chairman of Otolaryngology Section: Dr. Robert W. Godwin.  
Secretary of Otolaryngology Section: Dr. Francis O'N. Morris.  
Place: Los Angeles County Medical Association Bldg., 1925 Wilshire  
Blvd., Los Angeles, Calif.  
Time: 6:30 P.M. last Monday of each month from September to June,  
inclusive—Otolaryngology Section. 6:30, first Thursday of each month  
from September to June, inclusive—Ophthalmology Section.

**LOUISIANA-MISSISSIPPI OPHTHALMOLOGICAL  
AND OTOLARYNGOLOGICAL SOCIETY.**

President: Dr. Fred D. Hollowell, Lamar Life Bldg., Jackson, Miss.  
Secretary: Dr. Edley H. Jones, 1301 Washington St., Vicksburg, Miss.  
Meeting:



**MEMPHIS SOCIETY OF OPHTHALMOLOGY  
AND OTOLARYNGOLOGY.**

Chairman: Members serve as chairmen in alphabetical order monthly.  
Secretary-Treasurer: Dr. Roland H. Myers, 1720 Exchange Bldg., Memphis, Tenn.  
Assistant Secretary-Treasurer: Dr. William F. Murrah, Jr., Exchange Bldg., Memphis, Tenn.  
Meeting: Second Tuesday in each month at 8:00 P.M. at Memphis Eye, Nose and Throat Hospital.

**MEXICAN ASSOCIATION OF PLASTIC SURGEONS.**

President: Dr. Cesar LaBorde, Mexico, D. F.  
Vice-President: Dr. M. Gonzales Ulloa, Mexico, D. F.  
Secretary: Dr. Juan De Dios Peza, Mexico, D. F.

**MEXICAN SOCIETY OF OTOLARYNGOLOGY.**

President: Dr. Rafael Giorgana.  
Secretary: Dr. Carlos Valenzuela, Petrarca 332-1, Mexico 5, D. F.

**MISSISSIPPI VALLEY MEDICAL SOCIETY.**

President: Dr. Arthur S. Bristow, Princeton, Mo.  
Secretary-Treasurer: Dr. Harold Swanberg, Quincy, Ill.  
Assistant Secretary-Treasurer: Dr. Jacob E. Reisch, Springfield, Ill.

**NETHERLANDS SOCIETY OF OTO-RHINO-LARYNGOLOGY.  
(Nederlandsche Keel-Neus-Oorheelkundige Vereeniging.)**

President: Dr. H. Navis, Sonsbeekweg 6, Arnhem.  
Secretary: Dr. W. H. Struben, J. J. Viottastraat 1, Amsterdam.  
Treasurer: Mrs. F. Velleman-Pinto, Jac. Ohrechtstr. 66, Amsterdam.

**NORTH CAROLINA EYE, EAR, NOSE AND THROAT SOCIETY.**

President: Dr. J. C. Peele, Kinston Clinic, Kinston, N. C.  
Vice-President: Dr. George E. Bradord, Winston-Salem, N. C.  
Secretary-Treasurer: Dr. J. D. Stratton, 1012 Kings Drive, Charlotte 7, N. C.  
Meeting:

**NORTH OF ENGLAND OTOLARYNGOLOGICAL SOCIETY.**

President: Mr. G. L. Thompson, 16 Ramshill Road, Scarborough, Yorkshire.  
Vice-President: Mr. J. H. Otty, Frizley Old Hall, Frizinghall Road, Bradford, Yorkshire.  
Secretary and Treasurer: Mr. R. Thomas, 27 High Petergate, York, Yorkshire.

**OREGON ACADEMY OF OPHTHALMOLOGY AND  
OTOLARYNGOLOGY.**

President: Dr. David D. DeWeese, 1216 S. W. Yamhill St., Portland 5, Ore.  
Secretary-Treasurer: Dr. Paul B. Myers, 223 Medical Dental Bldg., Portland 5, Ore.  
Meeting: Fourth Tuesday of each month from September through May, Henry Thiele Restaurant, 23rd and W. Burnside, Portland, Ore.

#### **OTOSCLEROSIS STUDY GROUP.**

President: Dr. E. P. Fowler, Jr., 180 Fort Washington Ave., New York 32, New York.  
Secretary-Treasurer: Dr. Arthur L. Juers, 1018 Brown Building, Louisville 2, Ky.  
Meeting: Palmer House, Chicago, Ill., October, 1960.

#### **PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY.**

President: Dr. John F. Tolan, 1118 - 9th Ave., Seattle 5, Wash.  
Secretary-Treasurer: Dr. Homer E. Smith, 686 Twelfth Ave., Salt Lake City, Utah.  
Meeting:

#### **PAN AMERICAN ASSOCIATION OF OTO-RHINO-LARYNGOLOGY AND BRONCHO-ESOPHAGOLOGY.**

President: Dr. Paul Holinger, 700 No. Michigan Blvd., Chicago, Ill.  
Executive Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40, Pa., U. S. A.  
Meeting: Seventh Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology.  
Time and Place: Miami, Fla., March, 1960.

#### **PHILADELPHIA LARYNGOLOGICAL SOCIETY.**

President Dr. John J. O'Keefe.  
Vice-President: Dr. Joseph P. Atkins.  
Secretary: Dr. William A. Lell.  
Executive Committee: Dr. Harry P. Schenck, Dr. Benjamin H. Shuster, Dr. William A. Lell, Dr. William J. Hitschler, and Dr. Chevalier L. Jackson.

#### **PHILIPPINE SOCIETY OF OTOLARYNGOLOGY AND BRONCHO-ESOPHAGOLOGY.**

President: Dr. Macario G. Tan, 426 Evangelista, Manila, P. I.  
Vice-President: Dr. Ariston G. Bautista, 460 Isaac Peral, Manila, P. I.  
Secretary-Treasurer: Dr. Angel Enriquez, American Hospital, Aduana St., Manila, P. I.

#### **PITTSBURGH OTOLOGICAL SOCIETY.**

President: Dr. Emory A. Rittenhouse, 203 Masonic Bldg., McKeesport, Pa.  
Vice-President: Dr. Carson S. Demling, 513 Jenkins Bldg., Pittsburgh 22, Pa.  
Secretary-Treasurer: Dr. Clyde B. Lamp, 8101 Jenkins Arcade, Pittsburgh 22, Pa.

#### **PORTUGUESE OTORHINOLARYNGOLOGICAL SOCIETY.**

President: Dr. Albert Luis de Mendonca.  
Secretary: Dr. Antonio da Costa Quinta, Avenida, de Liberdade 65, 1° Lisbon.

#### **PUGET SOUND ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.**

President: Dr. Clifton E. Benson, Bremerton, Wash.  
President-Elect: Dr. Carl D. F. Jensen, Seattle, Wash.  
Secretary: Dr. Willard F. Goff, 1215 Fourth Ave., Seattle, Wash.

#### **SIXTH INTERNATIONAL CONGRESS ON DISEASES OF THE CHEST.**

Meeting: University of Vienna, August 29 to September 1, 1960.

#### RESEARCH STUDY CLUB OF LOS ANGELES, INC.

Chairman: Dr. Orrie E. Ghrist, 210 N. Central Ave., Glendale, Calif.  
Treasurer: Dr. Norman Jesberg, 500 So. Lucas Ave., Los Angeles 17, Calif.  
Otolaryngology: Dr. Russell M. Decker, 65 N. Madison Ave., Pasadena 1, Calif.  
Ophthalmology: Dr. Warren A. Wilson, 1930 Wilshire Blvd., Los Angeles 57, Calif.  
Mid-Winter Clinical Convention annually, the last two weeks in January at Los Angeles, Calif.

#### SECTION OF OTOLARYNGOLOGY OF THE MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA.

Chairman: Dr. J. L. Levine.  
Vice-Chairman: Dr. Russell Page.  
Secretary: Dr. James J. McFarland.  
Treasurer: Dr. Edward M. O'Brien.  
Meetings are held the second Tuesday of September, November, January, March and May, at 6:30 P.M.  
Place: Army and Navy Club, Washington, D. C.

#### SCOTTISH OTOLARYNGOLOGICAL SOCIETY.

President: Dr. F. T. Land, 13 Newton Place, Glasgow, C. 3.  
Secretary-Treasurer: Dr. J. F. Birrell, 14 Moray Place, Edinburgh.  
Assistant Secretary: Dr. H. D. Brown Kelly, 11 Sandyford Place, Glasgow, C. 3.

#### SOCIEDAD COLUMBIANA DE OFTALMOLOGIA Y OTORRINOLARINGOLOGIA (BOGOTA, COLUMBIA).

Presidente: Dr. Alfonso Tribin P.  
Secretario: Dr. Felix E. Lozano.  
Tesorero: Dr. Mario Arenas A.

#### SOCIEDAD CUBANA DE OTO-LARINGOLOGIA.

President: Dr. Reinaldo de Villiers.  
Vice-President: Dr. Jorge de Cárdenas.  
Secretary: Dr. Pablo Hernandez.

#### SOCIEDAD DE ESTUDIOS CLINICOS DE LA HABANA.

Presidente: Dr. Frank Canosa Lorenzo.  
Vice-Presidente: Dr. Julio Sanguliy.  
Secretario: Dr. Juan Portuondo de Castro.  
Tesorero: Dr. Luis Ortega Verdes.

#### SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA.

Presidente: Dr. Aldo Remorino.  
Vice-Presidente: Dr. Luis E. Olsen.  
Secretario: Dr. Eugenio Romero Díaz.  
Tesorero: Dr. Juan Manuel Pradales.  
Vocales: Dr. Osvaldo Suárez, Dr. Nondier Asis R., Dr. Jorge Bergallo Yofre.

#### SOCIEDAD DE OTO-RINO-LARINGOLOGIA, COLEGIO MEDIO DE EL SALVADOR, SAN SALVADOR, C. A.

President: Dr. Salvador Mixco Pinto.  
Secretary: Dr. Daniel Alfredo Alfaro.  
Treasurer: Dr. Antonio Pineda M.

#### **SOCIEDAD ESPANOLA DE OTORRINOLARINGOLOGIA.**

Presidente: Dr. D. Adolfo Hinojar Pons.  
Vice-Presidente: Dr. D. Jose Perez Mateos.  
Secretario General: Dr. D. Francisco Marañés.  
Tesorero: Dr. D. Ernesto Alonso Ferrer.

#### **SOCIEDAD MEXICANA DE OTORRINOLARINGOLOGIA**

Monterrey 47-201  
Mexico 7, D. F.

President: Dr. Rafael Giorgana.  
Secretary: Dr. Carlos Valenzuela.  
Treasurer: Dr. Benito Madariaga.  
First Vocal: Dr. Rafael González.  
Second Vocal: Dr. Juan Oberhauser.

#### **SOCIEDAD NACIONAL DE CIRUGIA OF CUBA.**

Presidente: Dr. Reinaldo de Villers.  
Vice-Presidente: Dr. César Cabrera Calderin.  
Secretario: Dr. José Xirau.  
Tesorero: Dr. Alfredo M. Petit.  
Vocal: Dr. José Gross.  
Vocal: Dr. Pedro Hernández Gonzalo.

#### **SOCIEDAD OTO-RINO-LARINGOLOGIA DE LOS HOSPITALES DE MADRID.**

Presidente: Dr. Don Fernando Beltrán Castillo.  
Secretario General: Dr. Don Alfonso Vassallo de Mumbert.  
Tesorero: Dr. Don Rafael García Tapia.

#### **SOCIEDAD VENEZOLANA DE OTORRINOLARINGOLOGIA.**

Presidente: Dr. Gabriel Briceño Romero.  
Vice-Presidente: Dr. Silvestre Rincón Fuenmayor.  
Secretario General: Dr. Oscar Bustamante Miranda.  
Tesorero: Dr. Arturo Marrero Gómez.  
Vocales: Dr. Miguel Octavio Russa, Dr. Benjamin Briceño, Dr. Oscar González Castillo.

#### **SOCIEDADE DE OFTALMOLOGIA E OTORRINOLARINGOLOGIA DO RIO GRANDE DO SUL.**

President: Dr. Ivo Adolpho Kuhl.  
Secretary: Dr. Decio Lisboa Castro.  
Treasurer: Dr. Jorge Valentin.

#### **SOCIEDAD PANAMENA DE OTORRINOLARINGOLOGIA.**

Presidente: Dr. Manuel Preclado.  
First Vice-Presidente: Dr. Alonso Roy.  
Second Vice-Presidente: Dr. Carlos Arango Carbone.  
Secretario: Dr. Maria Esther Villalaz.  
Tesorero: Dr. Ramón Crespo.

**SOCIEDADE PORTUGUESA DE OTORRINOLARINGOLOGIA  
E DE  
BRONCO-ESOFAGOLOGIA.**

Presidente: Dr. Alberto Luis De Mendonca.  
Vice-Presidente: Dr. Jaime de Magalhaes.  
1.º Secretario: Dr. Antonio da Costa Quinta.  
2.º Secretario: Dr. Albano Coelho.  
Tesoureiro: Dr. Jose Antonio de Campos Henriques.  
Vogais: Dr. Teofilo Esquivel.  
Dr. Antonio Cancela de Amorim.  
Sede: Avenida da Liberdade, 65, 1º, Lisboa.

**SOCIETY OF MILITARY OTOLARYNGOLOGISTS.**

President: Lt. Col. Stanley H. Bear, USAF (MC), USAF Hospital, Maxwell (Air University), Maxwell Air Force Base, Ala.  
Secretary-Treasurer: Capt. Maurice Schiff, MC, USN, U. S. Naval Hospital, Oakland, Calif.  
Meeting:

**SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY  
AND OTOLARYNGOLOGY.**

President: Dr. F. R. Price, 118 Rutledge Ave., Charleston, S. C.  
President-Elect: Dr. L. D. Lide, 161 W. Cheves St., Florence, S. C.  
Vice-President: Dr. R. E. Livingstone, 1505 Main St., Newberry, S. C.  
Secretary-Treasurer: Dr. Roderick Macdonald, 330 E. Main St., Rock Hill, S. C.

**SOUTHERN MEDICAL ASSOCIATION,  
SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY.**

Chairman: Dr. V. Eugene Holcombe, Charleston, W. Va.  
Chairman-Elect: Dr. G. Slaughter Fitz-Hugh, Charlottesville, Va.  
Vice-Chairman: Dr. George M. Haik, New Orleans, La.  
Secretary: Dr. Mercer G. Lynch, New Orleans, La.

**VIRGINIA SOCIETY OF OPHTHALMOLOGY  
AND OTOLARYNGOLOGY.**

President: Dr. Benjamin Sheppard, 301 Medical Arts Building, Richmond, Va.  
President-Elect: Dr. Emanuel U. Wallerstein, Professional Building, Richmond, Va.  
Vice-President: Dr. Calvin T. Burton, Medical Arts Building, Roanoke, Va.  
Secretary-Treasurer: Dr. Maynard P. Smith, 600 Professional Building, Richmond, Va.

**WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY  
AND OTOLARYNGOLOGY.**

President: Dr. Nime K. Joseph, Wheeling, W. Va.  
President-Elect: Dr. John A. B. Holt, Charleston, W. Va.  
Vice-President: Dr. William K. Marple, Huntington, W. Va.  
Secretary-Treasurer: Dr. Albert C. Esposito, Huntington, W. Va.  
Director for Two Years: Dr. James T. Spencer, Charleston, W. Va.

## NOTICE TO CONTRIBUTORS

THE LARYNGOSCOPE reserves the right of exclusive publication of all articles submitted. This does not preclude their publication in Transactions of various Societies.

Manuscripts should be typewritten, double spaced, on one side of paper only and with sufficient margins to allow for corrections.

Author's name and city should appear directly under title on first page; street address at end of article.

All prints or photographs to be submitted in black and white, in good sharp contrast. Good halftones depend upon clear photographs. Line drawings for zincs to be in black and white. Colored inks or red or blue quadrille rulings will not reproduce.

References should be complete: author's surname, initials, title of article, Journal, volume, page, month, year.

Six illustrations will be furnished for each article without cost to author. Authors will please limit illustrations to six or assume the expense of additional illustrations.

Proofs will be submitted to authors for corrections. If these are not returned, articles will be published as corrected in this office.

Reprints will be furnished at the following prices:

### WITHOUT COVER

	250 Copies	500 Copies	1000 Copies	2000 Copies
Four Pages	\$ 19.25	\$ 23.00	\$ 30.75	\$ 44.50
Eight Pages	33.50	42.75	58.50	83.00
Twelve Pages	47.00	60.75	86.25	131.50
Sixteen Pages	61.00	78.75	98.75	146.75
Twenty Pages	76.00	96.25	129.50	187.25
Twenty-four Pages	88.75	112.50	150.00	217.25
Twenty-eight Pages	97.50	123.25	162.25	233.50
Thirty-two Pages	115.00	139.75	180.00	267.00

### WITH COVER

	\$ 37.25	\$ 46.50	\$ 61.50	\$ 88.75
Four Pages				
Eight Pages	51.50	66.25	89.25	127.25
Twelve Pages	65.00	84.25	117.00	175.75
Sixteen Pages	79.00	102.25	129.50	191.00
Twenty Pages	94.00	119.75	160.25	231.50
Twenty-four Pages	106.75	136.00	180.75	261.50
Twenty-eight Pages	115.50	146.75	193.00	277.75
Thirty-two Pages	133.00	163.75	210.75	311.25

Express charges will be paid by consignee.

